TO COMPARE THE EFFECTIVENESS OF KINESIO TAPING AND SPLINTING TO ENHANCE HAND FUNCTION AND SELF CARE IN CHILDREN WITH SPASTIC CEREBRAL PALSY

DISSERTATION SUBMITTED

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THE TAMIL NADU DR. M.G.R MEDICAL UNIVERSITY,

CHENNAI

CERTIFICATE

` This is to certify that the research work entitled "**TO COMPARE THE EFFECTIVENESS OF KINESIO TAPING AND SPLINTING TO ENHANCE HAND FUNCTION AND SELF CARE IN CHILDREN WITH SPASTIC CEREBRAL PALSY"** was carried out by **Reg. No. 41101052,** KMCH College of Occupational Therapy**,** towards partial fulfilment of the requirements of Master of Occupational Therapy (advanced OT in Paediatrics) of the Tamil Nadu Dr. M.G.R. Medical University, Chennai.

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ABSTRACT

OBJECTIVE

The purpose of this study is to compare the effectiveness of kinesio Taping and splinting to enhance self care and hand function in children with spastic cerebral palsy.

METHODOLOGY

22 children (12 males and 10 females; 3 to 9 years of age) participated in this study. The Paediatric Evaluation of Disability Inventory (PEDI) and Earhart Developmental Prehension Assessment (EDPA) were used to measure pre and post score of self care and hand function. 11 children in experimental group received Kinesio Taping and 11 children in control group received splinting intervention. After 12 weeks of intervention duration the post test scores were taken in both the groups. Again a 3rd evaluation was done 15 days after the removal of kinesio Taping and splinting to determine the lasting effects on self care and hand function performance.

RESULTS

SPSS version 18 was used to analyse the study results. Descriptive and Inferential statistics were used to analyse the data's obtained. In both groups results showed statistical differences at 0.01 level in paired sample statistics. In independent sample statistics the Kinesio Taping group showed significant improvement in most of the components comparatively splinting group.

CONCLUSION

The study comparison confirm that the use of Kinesio Tape as an adjunct to treatment may assist with hand function and self care in occupational therapy pediatric rehabilitation settings than the dorsal cock-up with thumb opponens splint on thumb-in-palm deformity for children with spastic cerebral palsy.

INTRODUCTION

Hand skills are critical to interaction with the environment. The hands allow action through human contact and contact with objects. Hands are the "tools" most often used to accomplish work, play and to perform activities of daily living. The child who has disability affecting the hand skills lacks opportunity to manipulate with hands, thus has less sensory feedback from the environment there by experience of effect of his or her action on the world.

Thumb is the crucial factor of normal hand, can perform many prehensile patterns. Hand movements are extremely complex, they can be categorized into several basic prehensile and grasp patterns, including the following; fingertip, palmar and lateral prehension, cylindrical grasp, spherical grasp, hook grasp (**smith, weiss and lehmkuhl, 1996)** and intrinsic plus grasp. In most of the grip classifications, the thumb is contributing 40- 70% of hand function and others 20% (**Raj and Marquis, 1999)**.

The importance of thumb starts in utero itself as the child starts thumb sucking. It provides way of securing extra self nurturance for the child. The thumb- in- palm position is a normal one for an infant until about 3 months of age. Since then the digits come out of the fist as the child begins to develop more advanced motor patterns, especially grasping for objects. Persistence of thumb in palm position becomes worrisome in the presence of other motor delay or asymmetric use of the upper limbs.

The thumb –in- palm deformity is due to deforming forces, including the adductor pollicis and all thumb intrinsic muscles. The thumb metacarpophalangeal joint is often unstable and hyper extended. This signifies that the extensor power to the thumb will lift the entire thumb ray and not increase hyper extensive instability of the metacarpophalangeal joint. The etiology of the thumb- in- palm deformity, spasticity is the end pathway for the upper motor neuron dysfunction that may result from antenatal infarct, cerebral or meningeal infection or some form of syndromic spasticity

Several treatment strategies to correct thumb- in- palm deformity has been reported such as initially manipulation and splinting may help bring the thumb out of the palm. Surgical treatment depends on the type and degree of deformity the severity of the spasticity and the age of the children. The results of both surgical and corrective treatment can be

encouraging if the goals are carefully selected. The long term results shows deterioration because of the continual muscle imbalance, but in general the position of the thumb can be improved with the results of surgery prolonged careful attention in maintaining the correction with splinting until the completion of growth.

Studies justify that, thumb –in-palm deformity and web space contracture can adversely affect hand function and leads poor hygiene, self care skills for spastic CP children (JHS Vol 21 A 5, sep 1996). Self care skills reduced due to Thumb –in-palm deformity for spastic CP children (journal of ortho sug. 2008 dec 23 vol 3).

Kinesio Taping is relatively new techniques used in rehabilitation programs to treat upper arm function, though the above existing techniques and treatments for thumb in palm deformity are effective.The use of Kinesio Taping in conjunction with the childrean regular therapy program may favorably influence the cutaneous receptors of the sensorimotor system resulting in subsequent improvement of voluntary control and coordination.

The Kinesio Taping techniques is introduced by **Dr. KENZO KASE, DC.FOUNDER.** Kinesio Taping is made of 100% cotton and has elastic properties. It is this property that allows Kinesio Tape to work with the soft tissues of the baby versus restricting it. The Kinesio Tape is more elastic compared to conventional rigid tape. The non stretch rigid tape is used to limit unwanted joint movement or to protect and support a joint structure (**Grelsamer &Mc Connell, 1998; Macdonald, 1994**). Taping provide immediate sensory motor feedback regarding functional abilities .Important intervention objectives are to strengthen weakened muscles, to improve the quality of active ROM, and the child levels of independence with activities of daily living. Kinesio Taping when applied properly can theoretically improve the weakened muscles, enhance joint integrity, assist with postural alignment, and relax an overused muscle.

A study Investigating the effects of **Kinesio Taping in an Acute Pediatric Rehabilitation setting** (AJOT VOL.60 104-110 jan/feb 2006) shows **limitation** like a quasi experimental design with pre and post measure but no control group, without a control group no definitive conclusion can be drawn, although the study is **recommended** to test the effectiveness of this method and to determine the lasting effects on motor skills and functional performance once the tape is removed.

The current study attempts "**To compare the effectiveness of Kinesio Taping and splinting (dorsal cockup with thumb opponence splint) to enhance self care and hand function skills and to determine the lasting effect of self care and hand function in the spastic CP children** with the following research question,

- What is the difference between Kinesio Taping and splinting in correcting thumb in palm deformity to improve self care and hand function skills in CP spastic children?
- Will the improvement made duration can be preserved even after removal of kinesio Taping?

AIM AND OBJECTIVES

AIM

To compare the effectiveness of kinesio taping and splinting (dorsal cock-up with thumb opponens splint) to enhance self-care and hand function in children with spastic cerebral palsy.

OBJECTIVES

- To measure or evaluate the abnormality in hand function and self care due to thumb-in-palm deformity.
- To determine the effectiveness of kinesio Taping on self care and hand function.
- To determine the effectiveness of splinting on self care and hand function.
- To compare the difference between kinesio Taping and splinting in influencing on self care and hand function.
- To find out the dependent level of self care skills on caregiver.

OPERATIONAL DEFENITIONS

EFFECTIVENESS : Degree to which the desired result is produced.

SPLINT : Splint is "an orthopedic device for immobilisation, restraint or support of any part of the body".

KINESIO TAPE : Kinesio Taping is a technique, which work as specific elastic tapes. Kinesio Taping activates the neuromuscular and circulatory systems and also works with soft tissues of the body.

HYPOTHESIS

NULL HYPOTHESIS - 1

Kinesio Taping is not effective in enhancing hand function and self care.

ALTERNATE HYPOTHESIS – 1

Kinesio Taping is effective in enhancing hand function and self care.

NULL HYPOTHESIS - 2

Splinting is not effective in enhancing hand function and self care.

ALTERNATE HYPOTHESIS - 2

Splinting is effective in enhancing hand function and self care.

NULL HYPOTHESIS - 3

There is no significant difference between the treatment groups of kinesio Taping and splinting to enhancing hand function and self care.

ALTERNATE HYPOTHESIS -3

There is a significant difference between the treatment groups of kinesio Taping and splinting to enhancing hand function and self care.

RELATED LITERATURE

THUMB-IN-PALM DEFORMINTY

Thumb-in-palm deformity results from spasticity or contracture of the adductor pollicis or the spasticity of the flexors of the thumb or both.

It is very disabling as the thumb is in a poor position for effective function. Pulp-to-pulp and lateral pinch are lost. Grasp is hindered and entry of objects into the palm is blocked. In some patients, particularly those with tension athetosis, the thumb-in-palm position stimulates the so called gripping reflex, in which the fingers are clinched in the palm over the thumb.

Function of the thumb is intimately related to the position and stability of the wrist. On hyperflexion of the wrist, the fingers and thumb extend out of the palm. When the wrist is dorsiflexed and paced in the neutral position, the deformation of the thumb will be aggravated.

Stretching of the capsule may cause instability of the metacarpophalangeal joint of the thumb, resulting in hypermobility and subluxation which would interfere with complete extension of the thumb. Soft tissue contracture in the web space between the thumb and index metacarpals may develop in severe deformities; if left untreated, it will eventually cause subluxation of the carpometacarpal joint.

SIGNIFICANCE OF THUMB OPPOSITION

Prehension is evident in many forms of animal life. It attains maximum function in humans given the addition of thumb opposition. Opposition involves rotation at CMC joint of the thumb to place the thumb pad diametrically opposite to the pad of one or all of the other digits.

The thumb because of it's unique ability to oppose, it is a common feature in most grip classifications, contributing 40% to 70% of total hand function. The comparative length of the index finger to the thumb is a major factor when attempting opposition or pad – to – pad contact. A reduction in thumb length, seen in an individual whose distal thumb phalanx has been amputated, limits the ability to fully rotate the thumb to the index pad. Thumb

opposition in conjunction movement with other digits is used to execute functional prehension such as turning a door knob or buttoning a shirt.

SIGNIFICANCE OF OTHER DIGITS

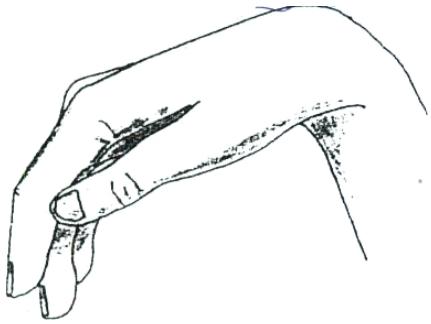
The index finger is considered the most important digit after the thumb because of its mobility of musculature attachments. It has been found to be the most dominant of the four fingers (**Raj & marquis 1999**) and accounts for 20% of lateral pinch, 20% of power grip from a supinated position of the forearm and 50% of power grip from a prorated forearm position **(tubiana, 1984**). The long finger is the longest & strongest and also has significant functional value.

In some individuals, it replaces the index finger as the dominant finger and is used for pointing and manipulating small objects (raj & marquis, 1999). The index & long fingers are considered the prehensile digits and are the most anatomically stable digits. The small and ring fingers are recruited for power grip prehension. Although they also are the weakest digits (Tubiana 1984), both the index and small fingers can produce isolated extension via the extensor indicis of the extensor digitiminimi. All of the digits are important in prehension and the loss of any one of them will limit prehensile ability to some degree.

CLASIFFICATION OF DEFORMITIES OF THE THUMB IN CEREBRAL PALSY (According to House et al.)

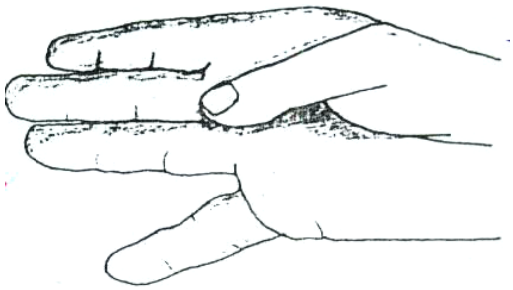
Type I: "Simple metacarpal adduction contracture"

In this form the 1st metacarpal is held in next to the 2nd metacarpal owing to spasticity and contracture of the adductor pollicis and first dorsal interosseous muscle. There may be secondary contracture of the skin web between the thumb and index metacarpals. Metacarpophalangeal and interphalangeal joints of the thumb have normal range of motion and the patient has varying degrees of voluntary cerebral control over the thumb extensors and flexors.



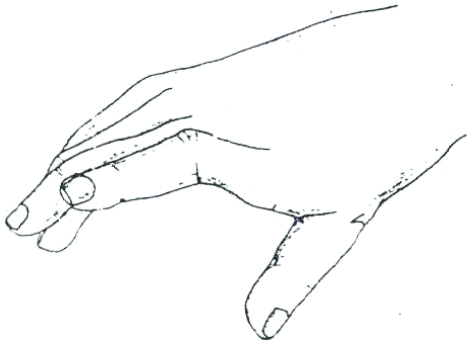
Type II: "Metacarpal adduction contracture and metacarpophalangeal flexion deformity"

In this form, in addition to the adduction contracture of the first metacarpal (as in Type I) there is flexion deformity of the thumb metacarpophalangeal joint due to spasticity and myostatic contracture of the flexor pollicis brevis muscle. There is normal mobility and relatively good function of the interphalangeal joint of the thumb.



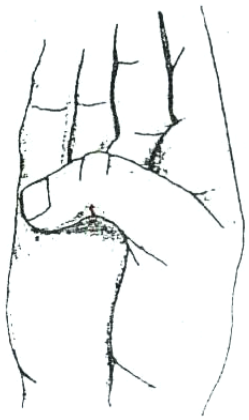
Type III: "Metacarpal adduction contracture combined with a matacarpophalangeal hyperextension deformity or instability"

In this type of deformity the flexor pollicis longus is not spastic, the first metacarpal is adducted, and the thumb metacarpophalangeal joint is unstable and hyperextensible owing to compensatory over activity of the Extensor Pollicis Longus and Brevis.



Type IV: "Metacarpal adduction contracture combined with flexion deformity of the metacarpophalangeal and interphalangeal joints"

This is caused by spasticity of the flexor pollicis longus in association with spasticity and contracture of the intrinsic muscles of the thumb. The severity of the thumb-in-palm deformity is most marked in this type and the disability is the greatest. The taut finger flexors trap the thumb under the flexed digits.



RELATIONSHIP OF HAND FUNCTIONS TO CHILDREN'S OCCUPATION

- **Activities of daily living (ADL)**

ADL also depends on the child's ability to use all types of hand skills. According to **Henderson**, the specific skills needed for skill development in this areas are ;

1. Abilities in grip.
2. The use of two hands in a complementary fashion.
3. The ability to use the hands in different positions with and without vision.
4. The execution of increasingly complex action sequence and
5. The development of automaticity**."(Henderson 1995).**

Case smith (1996) found that speed of object rotation using in-hand manipulation skills, grasp strength; motor accuracy and tool handling were each significantly positively correlated with self-care skills in pre-school age children receiving OT services.

Dressing skills involve complex grasp patterns and in-hand manipulation skills while using fasteners but the ability to use all types of bilateral skills and a variety of grasp patterns is useful for putting on and removing shirts, shoes, socks and pants. The ability to put on jewels relies in the ability to use delicate grasp patterns and in-hand manipulation.

Bathing, showering and other personal hygiene skills depend on the child's increasing fine motor skills in handling slippery objects (e.g soap). In addition, these skills are likely to be needed when an individual is in a standing position, such as while applying toothpaste on a toothbrush, brushing the teeth, shaving or applying makeup. A high level of skills in tool use is needed for complex hygiene activities such as shaving, applying makeup, using tweezers, cutting nails and styling hair (using barrettes, rubber-bands, curling iron, brush and hair dryer etc).

Eating skills rely on refinement of the ability to use forearm control with a variety of grasp patterns and tools. The ability to use both hands together effectively is necessary for spreading and cutting with a knife, opening all types of containers, pouring liquids and

preparing food. In-hand manipulation skills are used to adjust eating utensils and finger foods in the hand, to handle a napkin and to manipulate the opening of packed food and utensils.

THUMB FUNCTIONAL AND ANATOMICAL CONSIDERATIONS FOR SPLINTING

The thumb is essential for hand functions because of its overall importance to grip, pinch & fine manipulation. In fact, the thumb is frequently shown in disability ratings to impact as much as 50% of overall hand function (**Colditz, 1995**). The thumb's exceptional mobility results from the unique shape of its saddle joint, the arrangement of its ligaments and its intrinsic musculature (**Colditz, 1995; Belkin & English 1996; Tubiana thomine & Mackin 1996**). The thumb provides stability for grip, pinch & mobility as the thumb opposes the fingers for fine manipulations (**Wilton, 1997**). Sensory input to the tip of the thumb is important for functional grasp and pinch.

A thorough understanding of the anatomy & functional movements of the thumb is necessary before the therapist attempts to splint the thumb. The therapist must understand that the most crucial aspect of the thumb immobilization splint design is the position of the CMC joint (**Wilton 1997**). Positioning of thumb in palmar abduction using the splint's thumb post requires adequate abduction of the CMC joint. This position is critical for functional prehension.

THUMB TAPING

There are eight muscles that insert on the thumb. Four of the eight muscles are the extrinsic muscles that cross the wrist and four are intrinsic muscles of the thumb. Weakness or muscles imbalance of the thumb at the metacarpophalangeal (MCP) joint as a significant effect on the function and fine motor skills of the grasping between the thumb and digits.

Opposition is essential for grasping or prehensile movements, which requires reciprocal movements of the thumb and digits. **Napier** describes the adductor pollicis brevis as the muscle responsible for positioning the thumb biomechanically taking place at both the MCP and carpometacarpal (CMC) joint. Without activity of the abductor pollicis brevis, tip to tip prehension of the thumb and digits cannot be achieved.

Weathersby et al; evaluated the kinesiology of the thumb muscles. Electromyography was used to study the movement of the eight muscles of the thumb in ten test motions. The study found that six muscles were involved in five or more movements, and seven of the motions required contraction of five or more muscles to produce smooth, even, isotonic movement.

Children who present with increased spasticity or stiffness often demonstrates tightness into flexion and adduction. The muscle imbalance prevents the thumb from actively extending or abducting at the MCP and interphalangeal (IP) joint. There is tightness in the thenar eminence and the child often has difficulty with palmar expansion. The ability to extend the thumb is often impaired, and there may be a hyperextension of the IP or MCP joint with hyper mobility of the MCP joint. Prior to Kinesio Taping, it is important for the practitioner to observe isolated movements of the thumb, if present. The co-contraction of the muscles of the thumb demonstrates a delicate balance between the extrinsic and intrinsic muscles required for function. The inter-relationship of the thumb muscles must be considered when evaluating the muscle action and alignment for taping.

GENERAL PRINCIPLES OF KINESIO TAPING

1. The anchors of the tape are applied with no tension.

2. The tape can be left on for 3-5 days. Skin cells slough off in approximately 3-5 days which makes tape easier to take off. Do not leave the tape on for any longer than this amount of time.

3. The skin needs to rest for at least 24 hours after a taping application. However we can tape a different body area so continuous therapeutic input to soft tissue is possible. It is important to assess the skin prior and after any taping application. Some patients may need longer than 24 hour resting time.

4. Can shower and/or on bathe with tape on. Be sure not to use a hair dryer to dry the tape. This can cause the tape to adhere too aggressively to the skin. Use a towel to dry the tape.

5. Be sure to remove the tape immediately and gently if there is any skin irritation and / or sensitivity. If there is a question on whether a patient has skin sensitivities to the tape, try test piece (2-3 inches) of Kinesio Tex Tape with no tension prior to any therapeutic taping application in that area. Leave the tape on for 24 hours or unless the patient notices any skin irritation (Visual or sensory). If any sensitivity is noted do not use kinesio Tex Tape on that particular patient.

6. The majority of taping typically stays within the 15-25% tension (paper off) of available stretch for therapeutic applications. (Most skin irritation is due to too much tension being applied to the tape).

7. Tape is been applied approximately 20-30 minutes prior to an activity that has exposure to heat or sweat such as in a supporting activity.

8. Application of the tape can be done over a slight amount of hair. However if there is too much body hair, the patient will not have enough tape to skin contact to be effective clipping or shaving the hair may be required.

9. For best results, apply the Kinesio Tex Tape to both the symptom area and the cause of the symptom.

STRETCH AND RECOIL PRINCIPLES OF THE KINESIO TEX TAPE:

1. Stretch the tape away from anchor (portion with no tension) and the tail (portion and tension) will recoil back to anchor

2. In the case when there is an anchor on both ends, stretch both anchors away from the middle. The tape will recoil back to the middle.

3. To encourage shortening of muscle to facilitate tape origin to insertion
4. To encourage elongation of muscle to inhibit tape insertion to origin
5. Start the anchor in the direction you want the lymphatic's to flow to. The tails will want to recoil back to the anchor, directing the lymphatic to flow toward the anchor.

KINESIO TAPING TENSION PERCENTAGES GUIDELINES:

(Percentage of Available stretch in the tape)

None	Very Light	Light	Moderate	Severe	Full
0%	15%	25%	50%	75%	100%

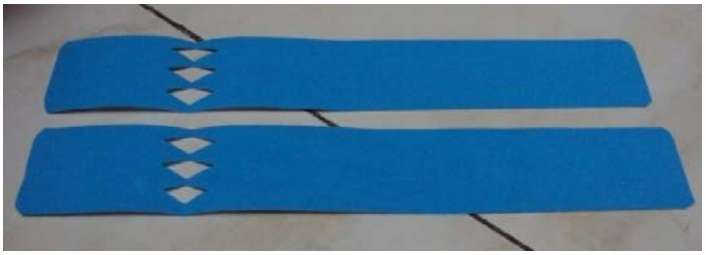
SHAPES OF KINESIO TEX TAPE CUTS

"I" Shaped Taping

"I" shaped tapes are cut Kinesio Tex Tapes with rounded ends. 'I' shaped tapes are used for muscle taping, correctional tapings, indurate tissue, and scar management.

"Web" Shaped taping

Web shaped tapes have 4-6 longitudinal strips in the middle of 2" wide kinesio Tex tape and 6-8 longitudinal strips in the middle of 3" wide kinesio Tex tape. This style of tape is used for correctional tapings, and indurate tissue.



"X" Shaped taping with "Donut" Hole"

X shaped taping with hole is the middle of Kinesio Tex Tape with both ends have longitudinal cuts in the middle of the tape. This tape also has a hole cut in the middle of the tape. X shaped tapes are used for correctional tapings and indurate tissue.

CORRECTIVE APPLICATION TECHNIQUE

Mechanical Correction "Recoiling"

Utilizes the stretching qualities of the Kinesio Tex Tape with inward pressure to provide for positional stimuli through the skin. The degree of stimulation is determined by the % age of stretch applied to the tape during application. Combined with the degree of inward pressure. Three techniques used are

1) Using the base of the Y to provide tension
2) Using the tails of the Y to provide tension
3) Using the tension in the centre of an I strip.

- ❖ Mechanical correction generally uses moderate to severe 50-75% of available tension.
- ❖ The practitioner may select to use full tension, if appropriate.

Functional Correction "Spring"

Used when the practitioner desires a sensory stimulation to either assist or limit a motion. The Kinesio Tex tape is applied to the skin with moderate to full or 50-100%of available tension during active movement.

The increased mechanoreceptor stimuli are believed to act as a pre load during end of motion positions.

TAPE APPLICATION

- Prior to tape application, make sure the skin is clean. The skin should be free of oils and be dry. A spray adherent or skin preparation wipe can be used on skin that has difficulty keeping the tape adhered. Be careful for pediatric and any other patient with sensitive skin.
- When taping moist areas such as the bottom of the feet or hands a more water-resistant Kinesio Tex Tape may be used.
- Typically the joint is moved through a full active or passive range of motion to provide a stretch on the tissue. But in case when more input is needed alternative position may be recommended.
- Lightly rubbing the tape activates the medical grade acrylic adhesive. This encourages the tape to adhere quickly to the skin.
- Avoid using hot packs or a heating source on Kinesio Tex Tape.

REMOVAL OF TAPE

- It is more comfortable to gently remove the tape in the direction of hair growth.
- The tape can be gently rolled off the skin slowly using the base of one hand. Use the fingers of the other hand to support the skin to reduce discomfort as the tape is being removed -or- Support the skin with the fingers of one hand while the tape is being slowly and gently removed with the other hand.
- Tape may be removed while showering or in bath.

POSSIBLE LIMITATIONS OF KINESIO TAPING METHOD

A limited number of patients may have excessive body hair & may require shaving or clipping.

- A limited of patients may not allow the application of the Kinesio Taping method due to their resistance to shaving
- Approximately 20-30 minutes is required for the glue to become fully activated before the patient can become physically active. If activity occurs prior to this lime, the tape may come off.
- If the Kinesio Tex Tape is applied during physical activity and extra adhesive may be needed to prepare the skin. Several commercially produced spray adherents are available. Once a spray adherent is used, the removal of the Kinesio tex Tape will be difficult. Commonly available tape adherent glue removes will not affect the adhesive glue since it is not rubber based as most athletic tapes.
- The patient may be unwilling or may misunderstand the 3 to 4 days application of the technique. The patient must be aware that the tape is to remain on for several days and can be worn while bathing or swimming. The tap does not have to be removed if it has become wet, only towel off excessive moisture and allow to air dry.

REVIEW OF LITERATURE

Yasukawa A., Patel P. & Sissung C. In the year 2006, conducted a pilot study investigating the effects of Kinesio Taping in an acute paediatric rehabilitation setting to describe the use of the Kinesio Taping method for the upper extremity in enhancing functional motor skills in children admitted into an acute rehabilitation program. 15 Children (10 females and 5 males: 4 to 16 years of age), who were receiving rehabilitation services at the Rehabilitation Institute of Chicago participated in the study. The Melbourne Assessment of Unilateral Upper Limb Function was used to measure upper limb functional change prior to the use of Kinesio Tape, immediately after application of the tape and 3 days after wearing the tape (subject impairments were – Right hemiplegia, T.B.I., C.P., C2-C6 S.C.I. lesion, Brain tumour, Left shoulder arthritis, C5-C6 S.C.I., sickle cell disease, multifocal osteomyelitis, incomplete tetraplegia, C6-C7 S.C.I., incomplete tetraplegia). Areas Taped were – Scapula stability, deltoid, postural correction, common areas covered in all subjects were wrist extension, thumb extension, thumb opposition, palmar stability, finger flexion, finger extension, wrist stability, back extensors and forearm supinators, triceps.

Result: The improvement from pre to post taping was statistically significant, $F(1, 14) = 18.9$; $P < 0.2$. The results suggest that Kinesio Taping may be associated with improvement in upper extremity control and function in the acute paediatric rehabilitation setting. The use of Kinesio Tape as an adjunct to treatment may assist with the goal – focused Occupational Therapy treatment during the child's inpatient stay. Further study recommends to test the effectiveness of this method and to determine the lasting effects on the motor skills and functional performance once the tape is removed.

Simsek T.T., Turkucuoglu B., Cokal N, Ustunbas G, Simsek I.E., in the year 2011 (march), in their study " The effects of Kinesio Taping on sitting posture, functional independence and gross motor function in children with cerebral palsy.", included 31 cerebral palsied children who scored as level III, IV or V according to gross motor function classification system (GMFCS). Children were randomly separated into two groups as study (n = 15, receiving KT and physiotherapy) and control (n = 15, receiving only physiotherapy). KT application was carried out for 12 weeks. Gross motor function measure (GMGM), functional independence measure for children (WeeFIM) and sitting assessment (SAS) were

used to evaluate gross motor function, independency in their activities of daily living and sitting posture respectively.

Results: Compared to initial assessments, both groups showed a significant difference in parameters of GMFCS sitting subscale, GMFCS total score and SAS scores (P<0.05>. At the end of 12 weeks, only SAS scores were significantly different in favour of the study group when the groups were compared ($p<0.05$). Also, post-intervention WeeFIM scores of the study group were significantly higher compared to initial assessment ($p<0.005$), however, no difference was detected in the control group ($p>0.05$). No direct effects of KT were observed on gross motor function and functional independence, tough sitting posture was affected positively. These results may imply that in clinical settings KT may be a beneficial assistive treatment approach when combined with physiotherapy.

Yesenia Rivera, MS, OTR/L & Norah K. Springgate, PT in 'A Newsletter for Milestones – For kids' Success "Stepping Stone" suggested that some of the benefits of Kinesio Taping for Children include assisting in the education of weakened muscles, helping to limit an over extension of over contraction of muscle tissue and assisting in the improvement of range of motion as well as over all joint function. She adds that Kinesio Taping therapy can be "Utilized for a short time to achieve a desired result, discontinues, and then reintroduced to treat either the same area or a new area of the body." Norah says "Kinesio Taping aims to give free range of motion, allowing the body's muscular system to heal itself biomechanically in order to improve function in the long term."

Nancy Konigsberg, MA, OTR/l,in dec.2010, in her study "Improve Sensory Integration and Neuro-muscular response with Kinesio Taping" described several therapists who applied Kinesio Taping to children with C.P. The tape gives Proprioceptive input to the muscle which helps inhibit the "spastic tone" and allows the weaker muscle effectively. It also can be used to improve low tone when placed strategically; the Proprioceptive input from the tape encourages the low tone muscle to contract. This can help children with low oral tone that has problems with mouth closure. It can also reduce drooling. When applied to certain areas of the abdomen, the Kinesio Tape can improve bowel elimination. For children with Proprioceptive problems and other sensory issues, the tape gives them sensory awareness of that body part which is taped. For that reason, it can be used to promote good postural alignment. The child can wear it for a few days; the tape continues to provide benefit

for the duration of the wearing schedule. Most treatments do to have that much carry-over benefit. The tape can be used on babies as well as older children.

Tulay Tarsusla Simsek, Bahriye Turkucuoglu, Gonca Ustunbas, Nilay Cokal in the year 2011, "Effects of Kinesio Taping on sitting posture and functional independence in children with myelomeningocele report of 4 cases" used sitting assessment scale to evaluate balance and posture during sitting, SCPM (Seated Postural Control Measure) has been used to evaluate sitting posture, Wee FIM was used to evaluate the level of function independence of the subjects. Kinesio Taping was applied on the erector spinae from spinal level of sacral 1 to cervical 7 in the Dr. Kase recommended (from origin to insertion). Kinesio Tape of 5 cm was used as "fan technique" to provide predominantly sensory stimulus on the erector spinae and application was performed bilaterally. The band was kept for 3 days on children who were applied Kinesio Tape. After 3 days on children, the band was removed and the region was kept free for 24 hours. Then the Kinesio Tape was applied again by the Physiotherapist. Subjects received rehabilitation for one hour, 3 days a week for 12 weeks. It included activities of upper extremity including grasping, letting go and extending, exercises directed to increase sitting and trunk balance and activities for taking the sitting position.

Conclusion: they found that Kinesio Taping application was beneficial in patients with a diagnosis of MINI. They believe that Kinesio Taping can be used clinically in children with poor sitting balance, weak body muscles & balance problems in body muscles in addition to P.T. and rehabilitation programs.

Cortesi M., Cattaneo D., Jonsdottir J. Neuro rehabilitation.2011; In "Effect of Kinesio taping on standing balance with multiple sclerosis: A pilot study" assessed the effect of Kinesio taping on body stability in subjects with MS. The study design was a non-controlled intervention study in a Rehabilitation Unit. A consecutive convenience sample of 15 individuals with multiple sclerosis was asses. Kinesio Tex Tape was applied directly to the skin of both calves and kept for the next two days. Clinical and stabilometric assessments were performed at baseline, immediately after application of the tape and the day after its removal. To control for learning effect, 10 subjects were tested repeatedly under the same conditions without the tape.

Results: No statistically or clinically relevant differences were observed among conditions in the mediolateral plane. In the AP plane Friedman's ANOVA showed statistically significant differences between baseline and taping condition with respect to length of sway. A trend towards statistically relevant differences was found also with respect to mean sway and velocity of sway. No learning effect was found for repeated testing within the non treated group. The preliminary results suggest that the use of ankle taping may be useful in immediately stabilising body posture.

Kim K.S., Seo H.M., Lee H.D year 2002, conducted a study on "Effects of Taping method on ADL range of motion, hand function and quality of life in post stroke patients for 5 weeks" The samples were selected from 20 post stroke hemiplegic patients at public health centre in the period from sep 5 to November 21 2001. The research design was one group pre test – post test design. The hemiplegic period of the participants was from 1-5 years. The pre and post test include measuring ADL, IADL, hand function, range of motion, quality of life, a treatment where to exposing taping therapy who had received self-help management programs. The tapes were applied to deltoid, supraspinatus, infraspinatus, brachioradialis with paralyzed extremity. The taping therapy was performed once a week for 5 weeks.

Results:

a. The score of BADL, was increased from 30.5 to 33.95 after program, and that was statistically significant (P = 0.019)
b. The score of IADL was increased from 11.6 to 12.75 after program and that was statistically insignificant (P = 0.161)
c. The score for hand function was increased from 17 to 25 after program and that was statistically significant (P = 0.026)
d. The shoulder's ROM (P = 0.000) wrists' ROM (P = 0.004) were statistically increased.

According to the results of the study Taping Therapy is effective for improving ADL, hand function, ROM, quality of life.

Jaraczewaka E, Long C, Top stroke rehabilitation, summer;13(3);31-42**.** " Kinesio Taping in stroke, improving functional use of the upper extremity in hemiplegia, at the Rehabilitation Institute of Chicago, Illinois, orthopaedic program describes that Kinesio Taping method in conjunction with other therapeutic intervention may inhibit muscle function, support joint structure, reduce pain and provide proprioceptive feedback to achieve

and maintain preferred body alignment. Restoring trunk & scapula alignment after Stroke is critical in an effective treatment program for the upper extremity in hemiplegia.

Patricia A. Burtner, PhD, OTR/L ,(2008). in the study "Effects of Wrist Hand splint on Grip, Pinch, Manual Dexterity and muscle activation in children with spastic hemiplegia: A preliminary study", found that dynamic splints increased function of children with CP while static splints decreased muscle activation at wrist & increased compensatory shoulder muscle recruitment. Ten Children with hemiplegic CP used hands with spasticity (n = 10) and 5 age matched control used dominant and non dominant hands (n = 10) in 3 splint conditions (no, dynamic and static) during grip, pinch and peg-board tests while EMG recorded muscle activation. Children with spasticity increased their grip (P = 0.008) and dexterity (P = 0.002) when wearing dynamic splints and pinch (P = 0.004) no splints. All the children had significantly less wrist EMG activity during grip with the static splint. All children with CP had greater compensatory shoulder activation. Preliminary findings suggest that dynamic splints increase function of children with CP while static splints decreased muscle activation at wrist & increased compensatory shoulder muscle recruitment.

CRITIQUE: Splint and Kinesio Taping In the book " Splinting The Hand And Upper Extremities – Principles And Process" by Marylynn A. Jacobs, Noelle M. Austin, chapter 13 pg. 282 concluded that Taping is not for every patient or therapist, it should be employed with caution and sound clinical judgement. In addition, taping should not be viewed as a replacement for traditional forms of splinting, because it holds a special place in upper extremity rehabilitation. The advantage of soft tissue support and increased joint mobility that taping provides place it in a class of its own. There is limited available research on McConnell or Kinesio Taping, unpublished anecdotal reports can be found on the World Wide Web, and clinical studies are in progress. The limitations of splinting may also be found with taping. Like patients may not want to wear the tape in public or may object to wearing the tape for a prolonged period of time. Patients may become frustrated when learning to handle and manage the tape. Therapist may have difficulty finding clinical education. A strong educational base is important but, as with all new skills, it takes time and practice to develop proficiency.

Sabine R. Ten Berge, et al in "A systemic evaluation of the effect of thumb opponens splints on hand function in children with unilateral spastic cerebral palsy" examined the effects of a neoprene thumb opponens splint on hand function during self-

selected activities of daily living task in children with unilateral spastic cerebral palsy with thumb-in-palm position of the affected hand. The design was systemic evaluation of 7 cases using multiple baselines across individuals. Setting: outpatient clinic, the subjects were 7 children with unilateral CP (2-7 years old). Manual Ability Classification System level 2-3 participated in the study. The intervention of Neoprene thumb opponens splints (necktie splint) was used. Children were followed for about 4 months. Baseline period ranged from 4 to 9 weeks, intervention period was 2 months and the duration of follow-up was one month. The main measure, Hand Function was assessed using Goal Attainment Scaling and Visual Analogue Scales. Data was assessed visually. The results, in 4 children Goal Attainment Scaling and/or Visual Analogue Scale scores increased after introducing the splint. These effects remained when the splints were not worn. Two children only benefited from the splint when it was Worn. Thumb opponens splints were tolerated well by all children who participated in the study. They concluded that Thumb Opponens Splints may have a positive effect on hand function in children with unilateral spastic C.P.

Retting A.C. Stube, K.S. Shelbourne K.D. "Effects of finger and wrist taping on grip strength" **Cara S. & Molteni** "Taping versus electrical stimulation after botulimun toxin type A injection for wrist & finger spasticity – A case control study"

Cepeda J.P. Fishweicher A, Gleeson et al "Does Kinesio Taping of the abdominal muscles improve the supine-to-sit transition in children with hyotonia?"

Randall, Johnson & Reddihough "Necktie Thumb Splints. 1999. The Melbourne Assessment of unilateral upper limb function.

CONCEPTUAL FRAME WORK

The thumb-in-palm deformity is due to deforming forces, including the adductor pollicis and all thumb intrinsic muscles. The thumb metacarpo phalangial joint is often unstable and hyper extended. This signifies that the extensor power to the thumb will lift the entire thumb ray and not increase hyper extensive instability of the metacarpo phalangeal joint.

In the neuro physiology of somatosensory system the muscle spindle detects both absolute muscle length and changes in muscle length and along with the 'monosynaptic reflex' help to finely regulate muscle length during movement. In humans, muscles with highest spindle density are extraoccular, hand and neck density.

The nuclear bag fibre has many spherical nuclei in its central noncontractile region, which stretches quickly when lengthened due to its elasticity, while the nuclear chain fibre has single row of nuclei being less elastic, stretches slowly, gamma Ia and II afferent neurons ending in dorsal root ganglion wrapped around the intra fusal fibres. The cutaneous receptor (mechanoreceptors, thermoreceptors and nocireceptors) carries information to the dorsal root ganglion of spinal cord from where it is carried to the higher centers in a heirarchial manner in several different ways.

At lower levels of the CNS hierarchy, cutaneous information gives to reflex movement. Information from the cutaneous system also ascends and provides information concerning body position essential for orientation with in the immediate environment.

The nervous system uses cutaneous information for reflex responses in various ways, depending on the extend and type of cutaneous input. A light, diffuse stimulus to the bottom of the hand tends to produce extension in the limb.

The above neurophysiology of somato sensory system is mainly based on **reflex theory**. **Sir Charles Sherrington**, neurophysiologist (1800s and early 1900s) the integrative action of nervous system (1906), his experimental foundation " reflex were the building blocks of complex behaviour". He believed that complex behaviour could be explained

through the combined action of individual reflexes that were chained together. In clinical implication he coined that retraining motor control for functional skills would focus on enhancing or reducing the effect of various reflexes during motor Function (forester, 1977)

In 2006, **Audney Yasukawa,** MOT, OTR, suggested that the use of Kinesio Tape in conjunction with the child's regular therapy program may favourably influence the cutaneous receptors of the sensorimotor system resulting in subsequent improvement of voluntary control and coordination of the upper limb. This concept has been adapted by the researcher in this current study.

In theories of motor learning- **Adam's Closed Loop Theory- Jack Adams (1971)** in his comprehensive theory suggests that,

- In a closed loop process, sensory feedback is used for ongoing production of skilled movement.
- Sensory feedback from ongoing motor areas was compared within nervous system with stored memory of intended movement
- He hypothesized that two distinct type of memory, the first is memory trace which is used in selection and initiation of movement. The second is perceptual trace which is built up over a period of practice and become the 'internal reference of correctness'. Movement is initiated by memory trace, the perceptual trace takes over to carry out movement and detect error.

In experimental group, Kinesio Taping, the concept of immediate sensory feedback, initiation of movement, internal reference of correctness and long lasting effects is based on this theory.

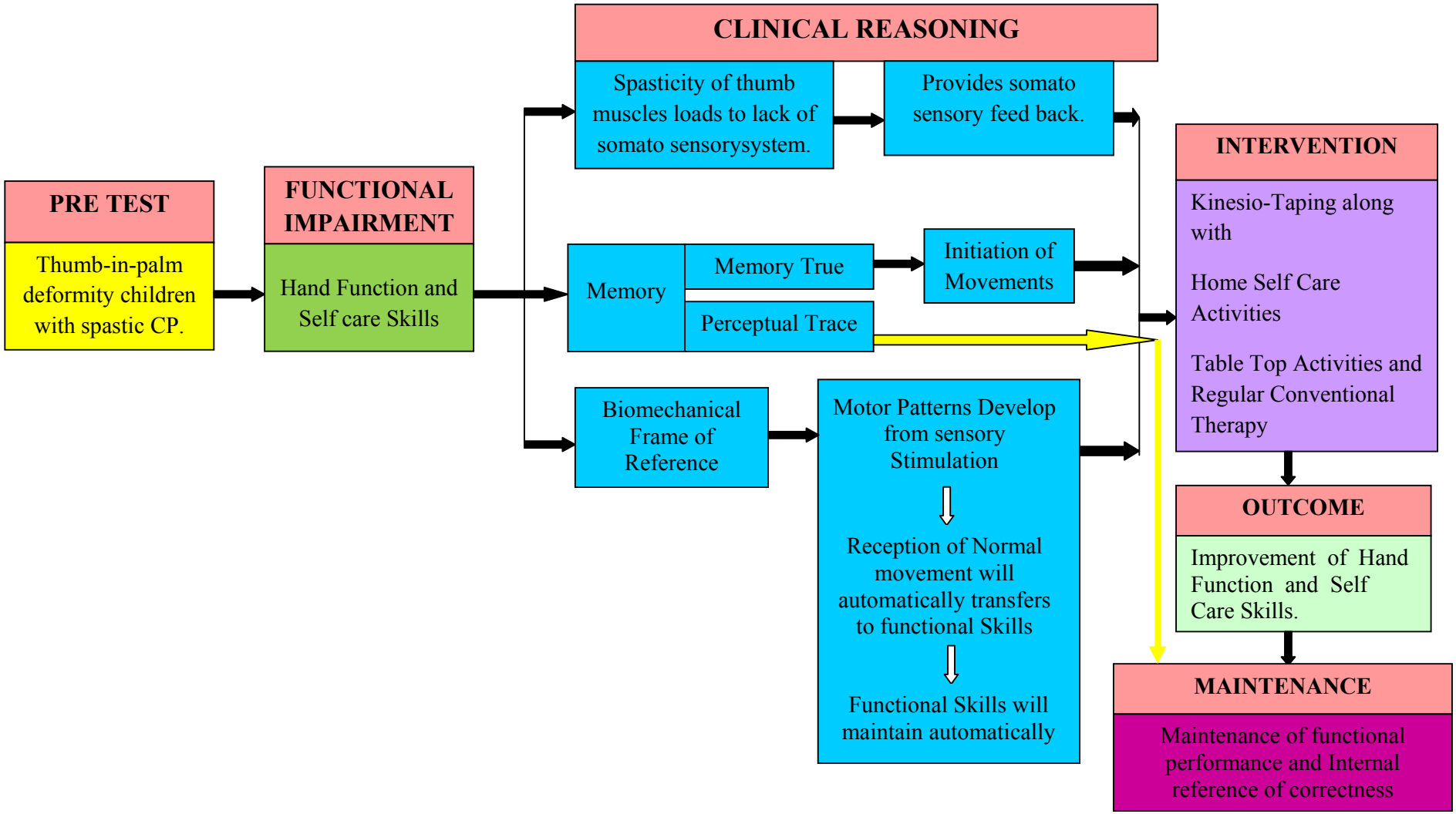
In this current study fair sitting balance and posture was taken as one of the inclusion criteria based on the concept of Pehoski. Pehoski (1992, 1995) was worked by Lawrence and Keypers (1968) to explain why distal control is not directly linked to proximal control. Two major systems are used in upper extremity. One system is responsible for postural control and proximal control, including integrated body- limb and body- head movements. This system comprises primarily the ventro medial brain stem pathways that synapse primarily with interneuron to trunk and proximal muscle. The second cortico spinal tract system originates from the primary motor cortex, and its fibres directly synapse with the motorneurons for the

hand muscles. Thus development of upper extremity skills and hand skills occurs because of proximal and distal mechanism, rather than as a result of one proximal tp distal mechanism.

The current study applies intervention based on the biomechanical frame of reference. Author **Cheryl Ann Colangelo** says biomechanical frame of Reference is used in combination of reflex based neuro facilitation approaches. The key assumptions for these approaches are;

- Functional skills will automatically return once abnormal movement patterns are inhibited and normal movement patterns facilitated.
- Reception of these normal movement patterns will automatically transfer to functional skills.
- Motor patterns develop from sensory stimulation.

CONCEPTUAL FRAME WORK



METHODOLOGY

The research methods applied by the investigator to compare the effectiveness of Kinesio Taping and splinting (Dorsal Cock-up with Thumb Opponens Splint) on thumb-in-palm deformity to enhance hand function and self care of spastic cerebral palsy children. The study duration started from December 2010 and it was completed on January 2012.

RESEARCH APPROACH

The quantitative approach used in this study is in relevance to quantify the effectiveness of Kinesio Taping and Splinting to enhance Hand Function and Self-care skills in children with spastic Cerebral palsy.

RESEARCH DESIGN

Two group pre-test and post-test quasi experimental design.

SCHEMATIC REPRESENTATION OF THE STUDY DESIGN

	TIME PERIOD- I		**TIME PERIOD- II**
Experimental Group (Kinesio Tape)	Level Of Phenomenon Before Treatment (K_1)	→	Level Of Phenomenon After Treatment (K_2)
Control Group (Splint)	Level Of Phenomenon Before Treatment (S_1)	→	Level Of Phenomenon After Treatment (S_2)

Intervention Expectation = $\mathbf{(K_2\text{-}K_1) \geq (S_2\text{-}S_1)}$

VARIABLES UNDER STUDY

INDEPENDENT VARIABLES:

Experimental group- Kinesio Taping

Control group- Splinting

DEPENDENT VARIABLES

Self-care skills

Hand function skills

PLACE OF THE STUDY

The study was conducted at,

- K.M.C.H. Department of Occupational Therapy.
- Ambika Paediatric Rehabilitation Centre (Goundampalam- Coimbatore-30).
- Sri Prashadhi Academy (Coimbatore and Tirupur branch).
- Union Panchayat School, SSA (Housing Unit-coimbatore).
- International Human Resource Development Centre of the Disable (HRDC) [Ramakrishna Mission Vivekananda University – Physiotherapy Department]

POPULATION

Cerebral Palsy children who had Thumb-in-palm deformity were taken for this study.

SELECTION CRITERIA

The subjects satisfying the following criteria were included in this study.

INCLUSION CRITERIA

- Both genders.
- Age group between 3 to 9 years,
- All type of thumb-in-palm deformity in children with spastic CP.
- Children with spastic hand graded on MAS (Modified Ashworth Scale 0-2).
- Children who are all having balance measured by the sitting to standing, stand to sitting and transfers components of the Paediatric Balance Scale (grade 1 and above).

EXCLUSION CRITERIA

- Non -coperativeness
- Who have difficulty in understanding simple 1-2 steps instructions (sever and profound M.R)
- Unmanageble Behavioural problems (e.g sever tantrum, hyperactive)
- Congenital hand/upper extrimities abnormalies and deformities of the hand (e.g. phocomelia, monomelia)

SAMPLING

Method: Under non-probability sampling the purposive or judgmental sampling was used.

Size: 22 CP. children divided into experimental and control groups (11 in each).

ASSESSMENT TOOLS USED

- Pediatric Evaluation Of Disability Inventory (PEDI): Calibrating The Duch Version- Part I-Functional Skills Scales (Self- Care Domain) and Part II- Caregiver Assisstance (Authors; **Custer**-Pediatric Physical Therapist. **Wassenberg Severijnen**-Social Scientist.
- Erhardt Developmental Prehension Assessment (EDPA)- Author; **Mrs. Rhoda P. Erhardt** MS,OTR,FAOTA.

PEDIATRIC EVALUATION OF DISABILITY INVENTORY

- Criterion reference test.
- Assess the child's self care, mobility and social functions.
- Assess the children aged between 6 months to 90 months (7.1/2yrs).

The PEDI contains items to measure functional capability, and also items to measure the performance in three content domains:

- Self Care (SC), Mobility (M) and Social Function (SF) Capability is measured by the assessment of the functional skills of which the child has shown mastery.
- These skills are rated in the Functional Skills Scales (FSS) and provide sufficient detail to identify clinical patterns of deficiencies in functional skill attainment.
- Actual performance is measured in the Caregiver Assistance Scales (CAS) by the extent of help a parent gives in daily functioning. Therefore, the CAS is an indirect measure of capability, where as the FSS is a direct measure.
- The CAS provides additional information to the results of the FSS: when children have mastered certain skills, this does not mean that they use those skills in actual performance.
- The Modifications Scale (MS) is a frequency count of the type and extent of environmental modifications that support functional performance.

Designed to use as an instrument

- ❖ To detect functional deficit or delay, and if that exists, the extent and content area of the delay or deficit.
- ❖ To evaluate individual or group progress in pediatric rehabilitation.
- ❖ To evaluate programs in pediatric rehabilitation.

SCORING

Functional Skills Scales (FSS)

0 – unable or limited in capability, to perform item in most situation.

1 – capable of performing item in most situations or item has been previously mastered and functional skills have progressed beyond this levels

Care Giver Assistance

0 = **total assistance**: child totally depends on the caregiver

1 = **maximal assistance**: caregiver does more than half the effort needed for performance, but the child does provide some meaningful assistance

2 = **moderate assistance**: child does more than half the effort, but the caregiver provides Substantial assistance

3 = **minimal assistance**: child does more than half the effort, the caregiver provides some assistance

4 = **supervision:** caregiver does not provide physical assistance, but supervises the performance

5 = **independent:** child performs the activity independent of the caregiver

The MS is not a measurement scale but a frequency count of types of modification required in performing the activity under ordinary circumstances:

N = no modifications

C = child oriented modifications, commonly used, non-specialized equipment

R = rehabilitation equipment, equipment normally not needed by non-disabled children

E = extensive modifications such as a wheelchair or major architectural alterations

PSYCHOMETRIC PROPERTIES

PEDIATRIC EVALUATION OF DISABILITY INVENTORY VALIDITY

- **Discriminative validity of the PEDI is,**

  Functional skills scale is .94

  Caregiver Assistance Scales .78

- **Content validity of the PEDI is,**

  Self care domain 97%

  Mobility domain 84%

  Social function 81%

RELIABILITY

Functional skills scale

	Self Care (74 Items)	**Mobility (61 Items)**	**Social (66 Items)**
Inter- Inter Viewer	0.99	0.99	0.99
Test- Retest	0.98	0.98	0.98
Inter- Respondent	0.99	0.99	O.97

Caregiver Assistance Scales & Modification Scale

	Self Care (8 Items)	**Mobility (7 Items)**	**Social (5 Items)**
Inter- Inter Viewer	0.99	0.99	0.99
Test- Retest	0.97	0.94	0.91
Inter- Respondent	0.91	0.97	0.93

ERHARDT DEVELOPMENTAL PREHENSION ASSESSMENT

VALIDITY

The correlation between the scores on the PDMS and the EDPA- R as 0.85 (P< 0.001).

RELIABILITY

The alpha co efficient for the total test was 0.89 indicating that there is a high level of internal consistency.

PROCEDURE

- A written consent was sought from the head of the institution to conduct this study.
- The purpose of the study was well explained and prior consent was obtained from the institutions, parents and care-givers.
- Subjects were selected according to the selection criteria
- Baseline activity was used for hand function and self care measured by EDPH and PEDI
- 22 children were divided into experimental and control groups with 11 in each group.
- **Application of kinesio Tape**
    - Prior to the application of the Kinesio Tape to the experimental group, precautionary skin test were administered.
    - The Kinesio tape was applied as "I" tape technique on Thumb Extension Assist, Thumb Metacarpo-Phalangeal Stability Taping, Thenar Eminence Taping and Wrist Extension Assist.
    - The band was kept for 3-5 d ays on the children.
    - After 3-5 days the band was removed and skin inspection was done (24 to 48 hours). Then the Kinesio Tape was applied again by the researcher.

- **Application of splinting**
    - Dorsal cock-up with thumb opposition splint was applied to the control group.

- ❖ The splint was made of Orfit material. The splint was made individually for each child, to maintain the hand in the functional position with thumb in opposition.
- ❖ Prior to application of the splint precautionary measure, care of splint and wearing schedule were taught to the parents (redness, joint prominence positioning, irritation)
- ❖ Once in 10 -15 days the children were reviewed

- ❖ Both group subjects received regular conventional therapy along with kinesio Taping and splinting.
- ❖ Application of kinesio Taping or splinting was continued for 12 weeks
- ❖ Post test evaluation was done using the same tools
- ❖ The 3rd evaluation was done after 15 days the removal of kinesio Taping and splinting
- ❖ The data were subjected to statically analysis.

COST ANALYSIS

Expenses of the Kinesio Taping & Splinting:

AGE	AREA	SPLINTING	KINESIO TAPING
		COST	**COST**
3-5	Material Used	150.00	500.00
	Making Charges	350.00	150.00
	Miscellaneous	100.00	--
	Total	**600.00**	**650.00**
6-9	Material Used	350.00	700.00
	Making Charges	350.00	150.00
	Miscellaneous	100.00	--
	Total	**800.00**	**850.00**

Direct Cost – Orfit material, Strapping, Rivets, and Travel cost, Tax, etc.

Indirect Cost – Average time required for the therapist to make, electricity, pans, scissors etc. (these are not much required for Kinesio Taping).

DATA ANALYSIS AND RESULTS

The results were analyzed by using Statistical Package for the Social Science **(SPSS) version 18.**

Descriptive Statistics; Organisation and Tabulation of Descriptive Data

- Table Percentage
- Measures Of Central Tendency

Inferential Statistics and Testing Hypothesis

- Paired 't' Test; paired sample statistics used to test the differences of same subjects, pre and post comparison of Kinesio Tape and splinting.
- Independent 't' Test; independent sample statistics used to compare the differences between the two independent groups of Kinesio Tape and splinting.

Analysis of Scores Obtained From EDPA

- From Table II to Table V

Analysis of Scores Obtained From FSS

- From Table VI to Table IX

Analysis of Scores Obtained From CGA

- From Table X to Table XIII

TABLE I

COMPARISON OF DEMOGRAPHIC DETAILS IN EXPERIMENTAL AND CONTROL GROUP

Variables	Groups	Kinesio Taping		Splinting	
		Number	**%**	**Number**	**%**
Age	< 5 yrs	5	27.23	4	36.37
	> 5 yrs	6	72.73	7	63.67
Gender	Male	5	45.50	7	58.30
	Female	6	54.50	4	36.40
Diagnosis	Quadriplegia	2	18.20	3	27.30
	Diplegia	4	36.40	3	27.30
	Rt. Hemi	3	27.30	2	18.20
	Lt. Hemi	2	18.20	3	27.30

Table I compares the demographic data of Experimental and Control Group.

TABLE II

EDPA- Comparison of Base Line Data and Out Come Measures of Kinesio Taping Group N=17.

VARIABLE	TEST	MEAN	S.D	T-VALUE	SIG
The Arm On Approach	Pre	9.529	2.183	4.667	.000
	Post	12.000	0.000		
GRASP Grasp The Dowel	Pre	7.235	2.223	4.862	.000
	Post	9.706	0.588		
Grasp The Cube	Pre	6.529	2.004	4.665	.000
	Post	8.529	0.624		
Grasp The Pellet	Pre	8.000	1.541	10.415	.000
	Post	10.353	1.455		
MANIPULATION a. Pattern component	Pre	12.353	3.258	3.356	.004
	Post	13.824	2.186		
b. Manipulation skills	Pre	12.412	3.144	3.476	.003
	Post	14.294	1.312		
RELEASE Release the dowel	Pre	8.706	2.024	7.948	.000
	Post	11.412	1.121		
Release the Pellet	Pre	10.647	2.448	6.359	.000
	Post	13.706	1.687		

Table II: Compares the pre test and post test scores of EDPA of Kinesio Taping group. The ‘t’ values for all the components are exists highly significant confident level of improvement.

GRAPH I

EDPA- Comparison of Base Line Data and Out Come Measures of Kinesio Taping Group N=17

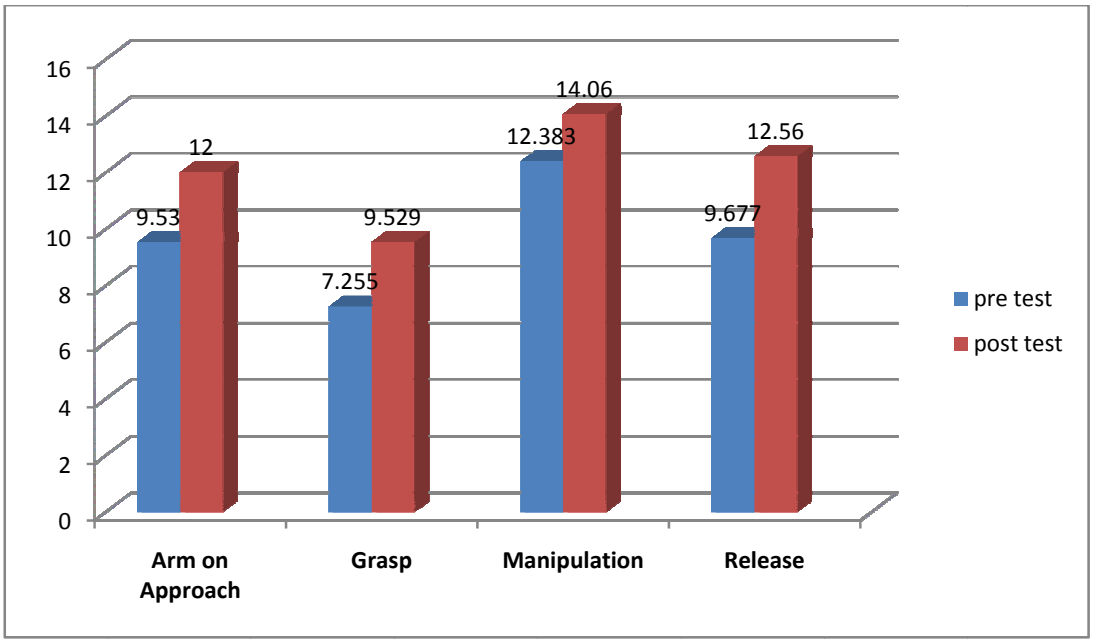


TABLE III

EDPA- Comparison of Base Line Data and Out Come Measures of Splinting Group N=17.

VARIABLE	TEST	MEAN	S.D	T-VALUE	SIG
The Arm On Approach	Pre	10.000	1.414	5.831	.000
	Post	12.000	0.000		
GRASP Grasp The Dowel	Pre	6.648	1.579	6.226	.000
	Post	8.882	0.697		
Grasp The Cube	Pre	5.530	0.273	9.601	.000
	Post	7.824	0.231		
Grasp The Pellet	Pre	7.294	1.047	6.769	.000
	Post	8.530	0.943		
MANIPULATION a. Pattern component	pre	11.824	3.147	3.559	.003
	Post	13.353	1.902		
b. Manipulation skills	Pre	10.765	2.948	4.781	.000
	Post	12.529	2.267		
RELEASE Release of the dowel	Pre	7.824	1.510	10.444	.000
	Post	10.588	1.622		
Release the Pellet	Pre	8.824	1.551	7.467	.000
	Post	12.059	2.015		

Table III: Compares the pre test and post test scores of EDPA of Splinting group. The‘t’ values for all the components are exists highly significant confident level of improvement.

GRAPH II

EDPA- Comparison of Base Line Data and Out Come Measures of Splinting Group

N=17

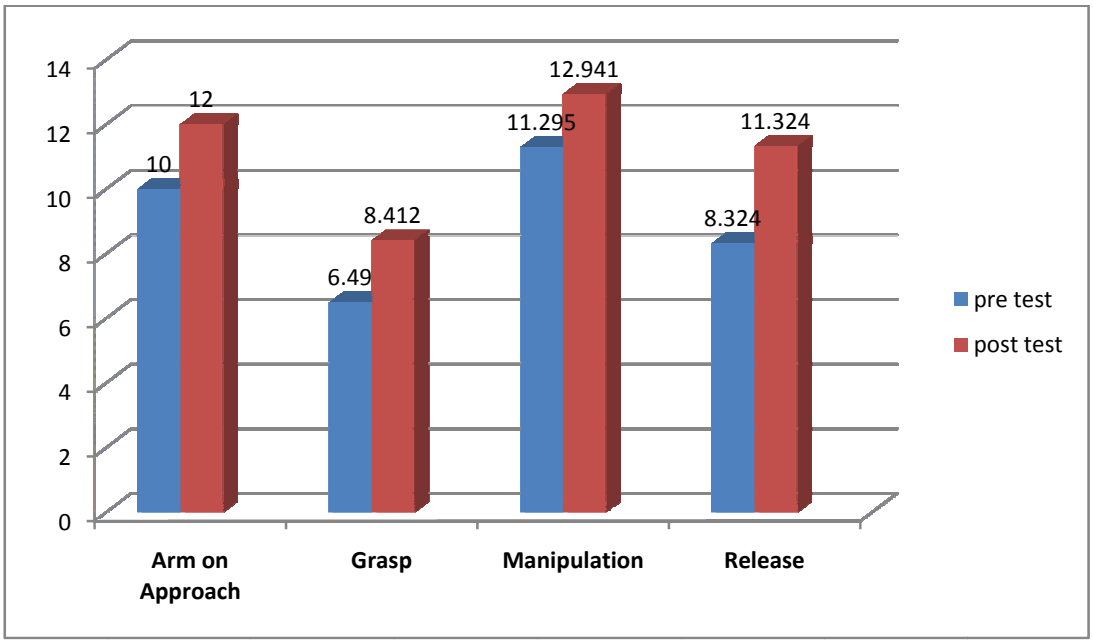


TABLE IV

EDPA -Comparison of Base Line Data Between Kinesio Taping and Splinting N=17.

VARIABLE	GROUPS	MEAN	S.D	T-VALUE	SIG
The Arm On Approach	KT	9.530	2.183	0.746	.461
	SP	10.000	1.414		
GRASP Grasp The Dowel	KT	7.235	2.223	0.890	.380
	SP	6.647	1.579		
Grasp The Cube	KT	6.530	2.004	1.794	.082
	SP	5.530	1.125		
Grasp The Pellet	KT	8.000	1.541	1.562	.128
	SP	7.294	1.047		
MANIPULATION a. Pattern component	KT	12.353	3.258	0.482	.633
	SP	11.824	3.147		
b. Manipulation skills	KT	12.411	3.144	1.576	.125
	SP	10.765	2.948		
RELEASE Release of the dowel	KT	8.706	2.024	1.441	.159
	SP	7.824	1.510		
Release of the pellet	KT	10.647	2.448	2.595	.014
	SP	8.824	1.551		

These tables compare the base line measures of EDPA for Kinesio Taping and Splinting groups. All the components are showing no significant difference except release of pellet. Hence all the components except release of pellet can be compared for post test measure.

TABLE V

EDPA -Comparison of Post Test Data Between Kinesio Taping and Splinting N=17

VARIABLE	GROUPS	MEAN	S.D	T-VALUE	SIG
The Arm On Approach	KT	12.000	0.000	-	-
	SP	12.000	0.000		
GRASP Grasp The Dowel	KT	9.706	0.588	3.725	.001
	SP	8.882	0.697		
Grasp The Cube	KT	8.530	0.624	2.558	.015
	SP	7.824	0.951		
Grasp The Pellet	KT	10.353	1.455	4.336	.000
	SP	8.529	0.943		
MANIPULATION A. Pattern component	KT	13.824	2.186	0.670	.508
	SP	13.353	1.902		
b. Manipulation skills	KT	14.294	1.312	2.778	.009
	SP	12.529	2.267		
RELEASE Release of the dowel	KT	11.412	1.121	1.722	.095
	SP	10.588	1.622		
Release the Pellet	KT	13.706	1.687		
	SP	12.059	2.015		

These tables compare the performance of hand function skills for Kinesio Taping and Splinting. The t- value cannot be computed for the component of arm on approach as the S.D of both the groups are 0. There exists a highly significant improvement in the components of grasp of the dowel, cube, pellet, and manipulation skills. The component of release and pattern component shows no significant difference.

TABLE VI: F_1

Comparison of Baseline Data and Outcome Measures of Functional Skills- Self Care Domain for Kinesio Taping Groups (N=11) (Feeding and Grooming)

VARIABLES	ITEMS	TEST	MEAN	S.D	T-VALUE	SIG
Feeding	Food	pre	4.000	0.000	-	-
		post	4.000	0.000		
	Use of utensil	pre	1.109	1.758	3.135	0.011
		post	3.455	1.508		
	Use of drinking container	pre	1.636	1.120	10.222	0.000
		post	4.546	0.934		
Grooming	Tooth brushing	pre	2.546	1.128	8.859	0.000
		post	4.273	0.905		
	Hair brushing	pre	1.727	0.786	9.238	0.000
		post	3.181	0.751		
	Nose care	pre	2.546	1.695	6.055	0.000
		post	4.546	0.820		
	Hand washing	pre	2.273	1.348	12.857	0.000
		post	4.364	1.348		
	Washing body and face	pre	1.000	0.894	11.628	0.000
		post	3.364	1.120		

The table shows that there exist a highly significant difference in both feeding and grooming.

TABLE VI: F_2

Comparison of Base Line Data and Outcome Measures of Functional Skills- Self Care Domain for Kinesio Taping Group (N=11) (Dressing and Toileting)

VARIABLE	ITEMS	TEST	MEAN	S.D	T-VALUE	SIG
Dressing	Pull over/front opening garment	Pre	1.636	0.809	8.515	0.000
		Post	4.273	1.348		
	Fasteners	Pre	1.455	1.036	7.216	0.000
		Post	3.909	1.036		
	Pants	Pre	2.182	0.982	6.633	0.000
		Post	4.182	0.982		
	Footwear	Pre	1.273	1.272	5.004	0.001
		Post	3.636	1.272		
Toileting	Toilet	Pre	1.182	0.751	7.016	0.000
		Post	2.636	0.750		
	Management of bladder	Pre	3.818	1.779	2.631	0.025
		Post	4.364	1.286		
	Management of bowel	Pre	3.909	1.758	2.093	0.038
		Post	4.273	1.421		

From the above table it is evident that the children in the Kinesio Taping group showed highly significant difference in all the variables in the comparison of base line and post test measures of functional skills- self care domain.

GRAPH III

Comparision Of Base Line Data And Outcome measures Of Functional Skills Scales-Self Care Domain (PEDI) For Kinesio Taping Group

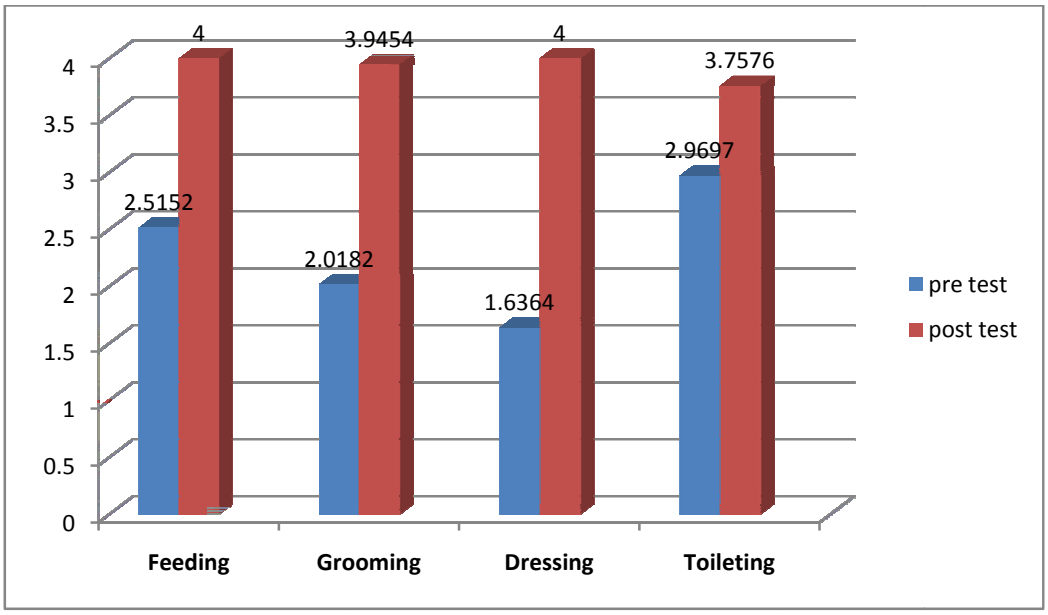


TABLE VII: F_1

Comparison of Baseline Data and Outcome Measures of Functional Skills- Self Care Domain for Splinting Groups (N=11) (Feeding and Grooming)

VARIABLES	ITEMS	TEST	MEAN	S.D	T-VALUE	SIG
Feeding	Food	pre	3.909	0.302	-	-
		post	3.909	0.302		
	Use of utensil	pre	3.546	1.555	4.183	0.002
		post	3.546	1.128		
	Use of drinking container	pre	2.456	1.128	6.708	0.000
		post	3.546	1.129		
Grooming	Tooth brushing	pre	2.363	1.120	3.993	0.003
		post	3.546	1.120		
	Hair brushing	pre	2.091	0.944	3.068	0.012
		post	2.818	0.944		
	Nose care	pre	3.000	1.483	3.464	0.006
		post	3.546	1.483		
	Hand washing	pre	1.546	1.368	6.708	0.000
		post	3.189	1.368		
	Washing body and face	pre	0.818	0.751	7.455	0.000
		post	2.364	1.027		

From the above table it is evident that there is highly significant differences in feeding and grooming in the comparison of pre and post test measures of functional skill- self care domain.

TABLE VII: F_2

Comparison of Base Line Data and Outcome Measures of Functional Skills- Self Care Domain for Splinting Group N=11 (Dressing and Toileting)

VARIABLE	ITEMS	TEST	MEAN	S.D	T-VALUE	SIG
Dressing	Pull over/front opening garment	Pre	1.091	0.701	3.730	0.04
		Post	1.818	0.606		
	fasteners	Pre	0.364	0.505	10.757	0.000
		Post	2.000	0.447		
	Pants	Pre	1.455	1.293	3.028	0.013
		Post	2.455	1.293		
	Footwear	Pre	1.909	1.300	4.303	0.002
		Post	2.818	1.167		
Toileting	Toilet	Pre	1.182	0.603	1.936	0.082
		Post	1.455	0.603		
	Management of bladder	Pre	3.636	1.027	2.390	0.038
		Post	4.000	0.273		
	Management of bowel	Pre	3.818	1.328	1.399	0.192
		Post	4.091	0.831		

The above table shows that all the variables show significant difference except toileting and management of bowel with t- values 1.936 and 1.399 respectively, significant at 0.082 and 0.192 levels.

GRAPH IV

Comparision Of Base Line Data And Outcome Measures Of Functional Skills Scales-Self Care Domain (PEDI) For Splinting Group.

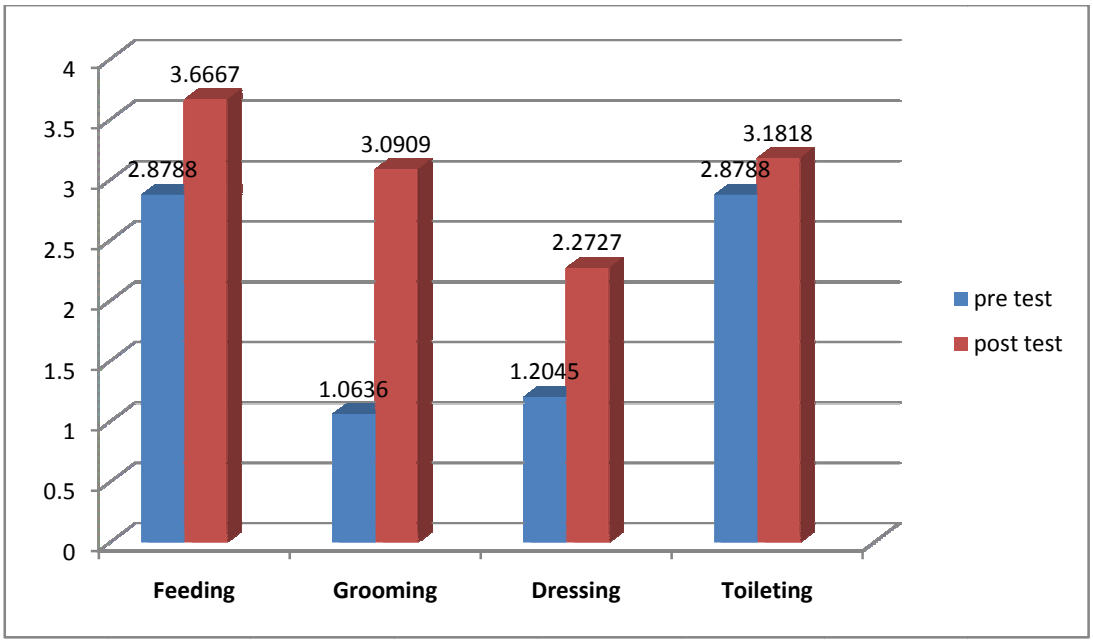


TABLE VIII: F_1

Comparison of Baseline Data to Measure of Functional Skills- Self Care Domain for Kinesio Taping and Splinting Groups N=11 (Feeding and Grooming)

VARIABLES	ITEMS	GROUPS	MEAN	S.D	T-VALUE	SIG
Feeding	Food	KT	4.000	0.000	1.000	0.329
		SP	3.909	0.301		
	Use of utensil	KT	1.909	1.758	0.514	0.613
		SP	2.273	1.555		
	Use of drinking container	KT	1.636	1.120	1.707	0.103
		SP	2.455	1.128		
Grooming	Tooth brushing	KT	2.546	1.128	0.379	0.708
		SP	2.364	1.120		
	Hair brushing	KT	1.727	0.786	0.982	0.338
		SP	2.091	0.944		
	Nose care	KT	2.545	1.694	0.669	0.511
		SP	3.000	1.483		
	Hand washing	KT	2.273	1.348	1.256	0.224
		SP	1.546	1.368		
	Washing body and face	KY	1.000	0.894	0.516	0.611
		SP	0.818	0.751		

From the above table it is evident that there is no significant difference between the experimental and control groups in the quantify of feeding and grooming measured by functional skills self care domain.

TABLE IX: F_1

Comparison of Post Test Data to Measure of Functional Skills- Self Care Domain for Kinesio Taping and Splinting Groups N=11 (Feeding and Grooming)

VARIABLES	ITEMS	GROUPS	MEAN	S.D	T-VALUE	SIG
Feeding	Food	KT	4.000	0.000	1.000	0.329
		SP	3.909	0.301		
	Use of utensil	KT	3.455	1.508	0.160	0.874
		SP	3.546	1.128		
	Use of drinking container	KT	4.544	0.934	2.510	0.021
		SP	3.546	0.934		
Grooming	Tooth brushing	KT	4.273	0.905	1.855	0.078
		SP	3.546	0.934		
	Hair brushing	KT	3.182	0.751	1.136	0.269
		SP	2.812	0.751		
	Nose care	KT	4.546	0.820	2.378	0.027
		SP	2.546	1.128		
	Hand washing	KT	4.364	1.206	2.120	0.047
		SP	3.182	1.401		
	Washing body and face	KT	3.364	1.120	1.027	0.041
		SP	2.364	1.027		

The above table clearly shows there is a significant difference between Kinesio Taping and splinting in the components of use of drinking container, nose care, hand washing and washing body and face.

GRAPH V

Comparing the Measures of Functional Skills Scales-Self Care Domain (PEDI) for Kinesio Taping and Splinting In the Components Feeding And Grooming

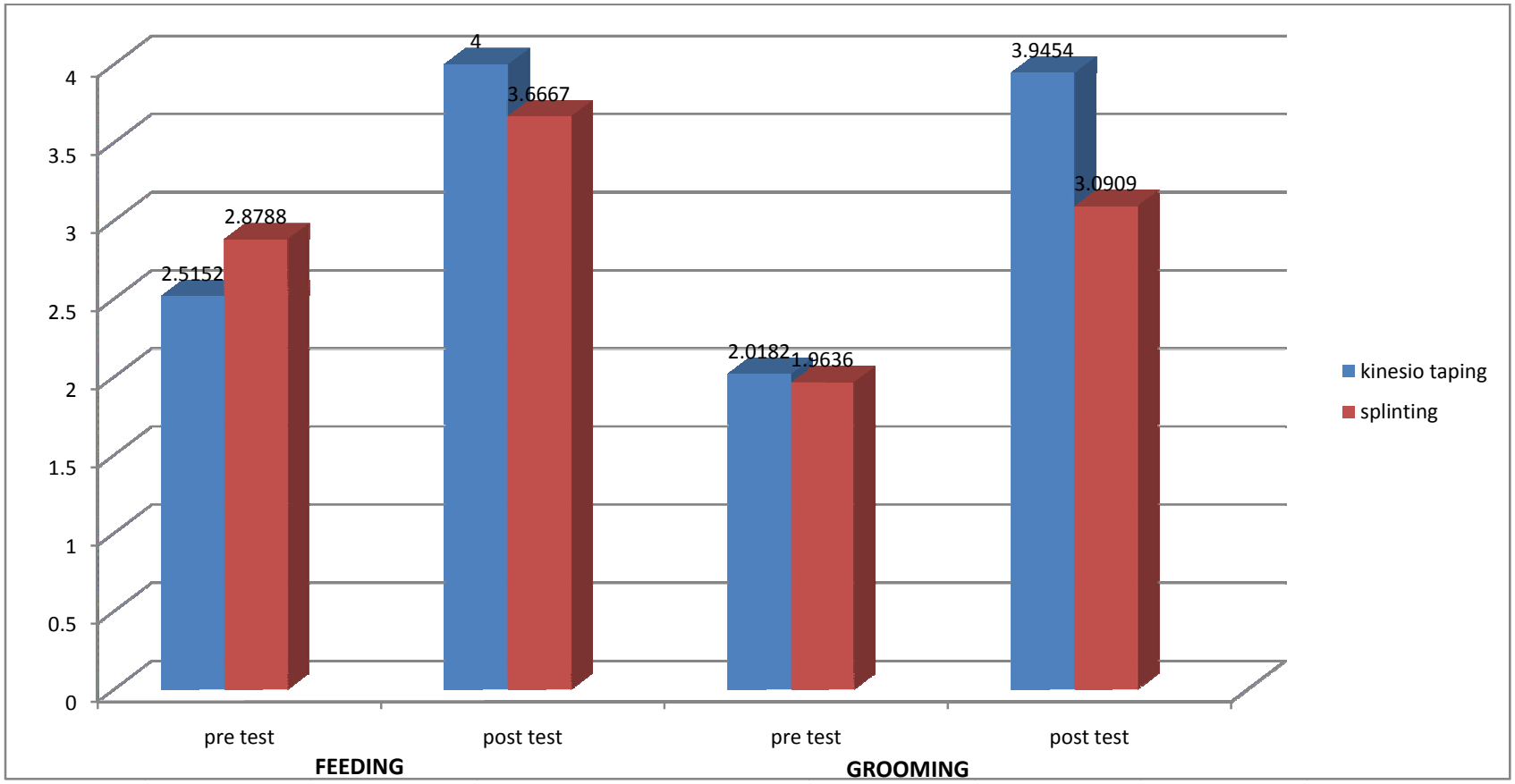


TABLE VIII: F_2

Comparison of Base Line Data to Measures of Functional Skills- Self Care Domain for Kinesio Taping and Splinting Group (N=11)(Dressing and Toileting)

VARIABLE	ITEMS	GROUPS	MEAN	S.D	T-VALUE	SIG
Dressing	Pull over/front opening garment	KT	1.636	0.809	1.69	0.106
		SP	1.091	0.701		
	Fasteners	KT	1.455	1.036	1.01	0.365
		SP	1.364	0.705		
	Pants	KT	2.182	0.982	1.486	0.153
		SP	1.455	1.293		
	Footwear	KT	1.273	1.272	1.160	0.260
		SP	1.909	1.300		
Toileting	Toilet	KT	1.182	0.751	0.000	1.000
		SP	1.182	0.603		
	Management of bladder	KT	3.818	1.779	0.294	0.772
		SP	3.636	1.027		
	Management of bowel	KT	3.909	1.758	0.137	0.893
		SP	3.818	1.328		

From the above table it is evident that there is no significant difference between experimental and control groups in the quantify of dressing and toileting measured by functional skills self care domain

TABLE IX: F_2

Comparison of Post test Data to Measures of Functional Skills- Self Care Domain for Kinesio Taping and Splinting Group (N=11)

(Dressing and Toileting)

VARIABLE	ITEMS	GROUPS	MEAN	S.D	T-VALUE	SIG
Dressing	Pull over/front opening garment	KT	4.273	1.348	5.511	0.000
		SP	1.818	0.603		
	fasteners	KT	3.909	1.814	3.389	0.003
		SP	2.000	0.447		
	Pants	KT	4.182	0.982	3.831	0.001
		SP	2.455	1.128		
	Footwear	KT	3.909	1.814	1.106	0.282
		SP	2.000	0.447		
Toileting	Toilet	KT	2.636	1.120	2.982	0.007
		SP	1.455	0.688		
	Management of bladder	KT	4.364	1.286	0.770	0.450
		SP	4.000	0.894		
	Management of bowel	KT	4.273	1.421	0.366	0.718
		SP	4.091	0.831		

The above table clearly shows that there is a significant difference between the Kinesio Taping and splinting in the components of pull over, fastness, pants and toilet skill, but in the components of foot wear, management of bladder and bowel there is no significant difference.

GRAPH VI

Comparing the Measures of Functional Skills Scales-Self Care Domain (PEDI) for Kinesio Taping and Splinting in the Components of dressing and toileting

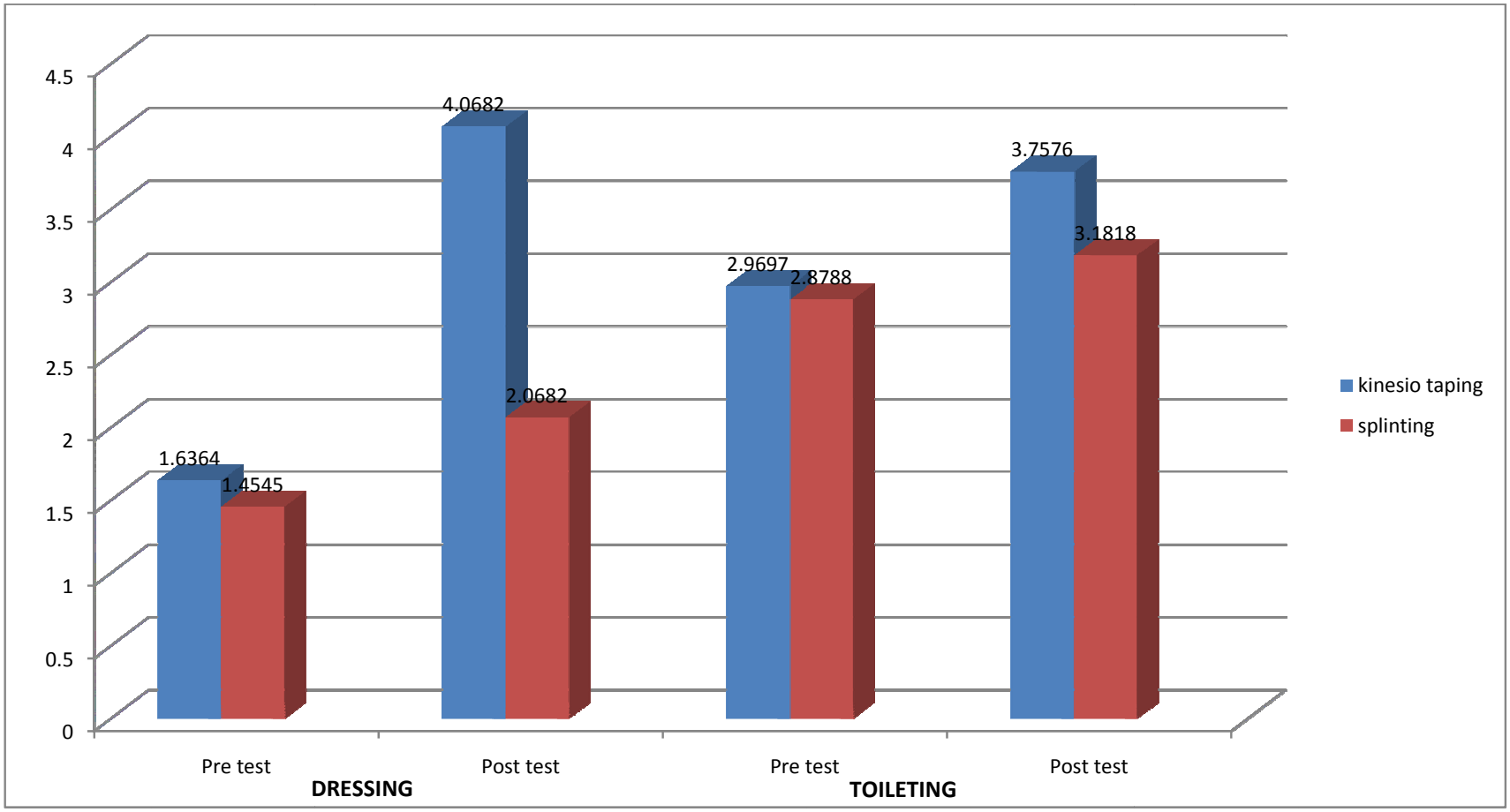


TABLE X

Comparison of Base Line Data and Out Come Measures of Care Giver Assistance for Kinesio Taping Group (N=11)

VARIABLE	TEST	MEAN	S.D	T-VALUE	SIG
Eating	Pre	2.727	1.009	6.249	0.000
	Post	4.273	0.905		
Grooming	Pre	2.000	1.000	6.708	0.000
	Post	3.636	1.206		
Bathing	Pre	1.455	0.820	9.037	0.000
	Post	2.727	0.647		
Dressing Upper Body	Pre	2.000	1.000	12.000	0.000
	Post	4.182	1.250		
Dressing Lower Body	Pre	1.546	0.934	12.857	0.000
	Post	3.636	1.027		
Toileting	Pre	1.818	1.401	6.500	0.000
	Post	3.000	1.096		
Bowel Management	Pre	1.909	0.945	6.708	0.000
	Post	3.000	0.632		
Bladder Management	Pre	2.273	1.191	8.964	0.000
	Post	3.636	1.120		

The table values show that, there exists a highly significant level of 0.00 in all the variables in Kinesio Taping in the comparison of the base line and outcome measures of the above mentioned scale.

TABLE XI

Comparison of Base Line Data and Out Come Measures of Care Giver Assistance for Splinting Group (N=11)

VARIABLE	TEST	MEAN	S.D	T-VALUE	SIG
Eating	Pre	3.091	1.221	1.150	0.277
	Post	3.364	0.924		
Grooming	Pre	2.182	0.982	3.730	0.004
	Post	2.909	0.831		
Bathing	Pre	1.091	1.044	6.708	0.000
	Post	1.909	1.044		
Dressing Upper Body	Pre	1.546	0.934	3.130	0.011
	Post	2.182	0.982		
Dressing Lower Body	Pre	1.273	0.905	3.130	0.011
	Post	1.909	1.044		
Toileting	Pre	1.546	1.128	3.730	0.004
	Post	2.273	1.009		
Bowel Management	Pre	1.455	0.688	4.183	0.002
	Post	2.091	0.831		
Bladder Management	Pre	2.455	1.368	4.183	0.002
	Post	3.091	1.221		

The above table shows that significant differences are noted in the outcome measures of all the components for splinting group children except in eating.

GRAPH VII

Comparison Of Base Line Data To The Outcome Measures Of Kinesio Taping And Splinting Groups

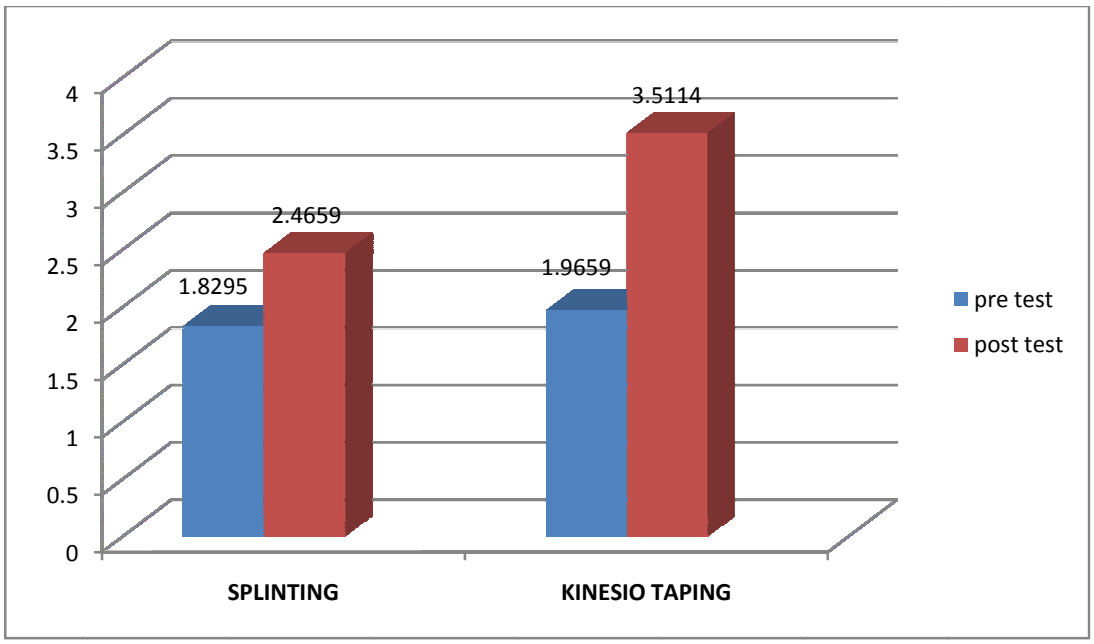


TABLE XII

Comparison of Base Line Data and Post Test Data of Care Giver Assistance between Kinesio Taping and Splinting Group (N= 11)

VARIABLE	GROUPS	MEAN	S.D	T-VALUE	SIG
Eating	K.T	2.727	1.009	0.761	.455
	SP	3.091	1.221		
Grooming	K.T	2.000	1.000	0.43	.672
	SP	2.182	0.982		
Bathing	K.T	1.455	0.820	0.908	.375
	SP	1.091	1.045		
Dressing Upper Body	K.T	2.000	1.000	1.102	.284
	SP	1.546	0.934		
Dressing Lower Body	K.T	1.546	0.934	0.696	.495
	SP	1.273	0.905		
Toileting	K.T	1.818	1.401	0.503	.621
	SP	1.546	1.128		
Bladder Management	K.T	2.273	1.191	0.332	.743
	SP	2.455	1.368		
Bowel Management	K.T	1.909	0.944	1.291	.211
	SP	1.455	0.688		

There was no significant difference between the experimental group and control group in quantify of self care measured by care giver assistance scale.

TABLE XIII

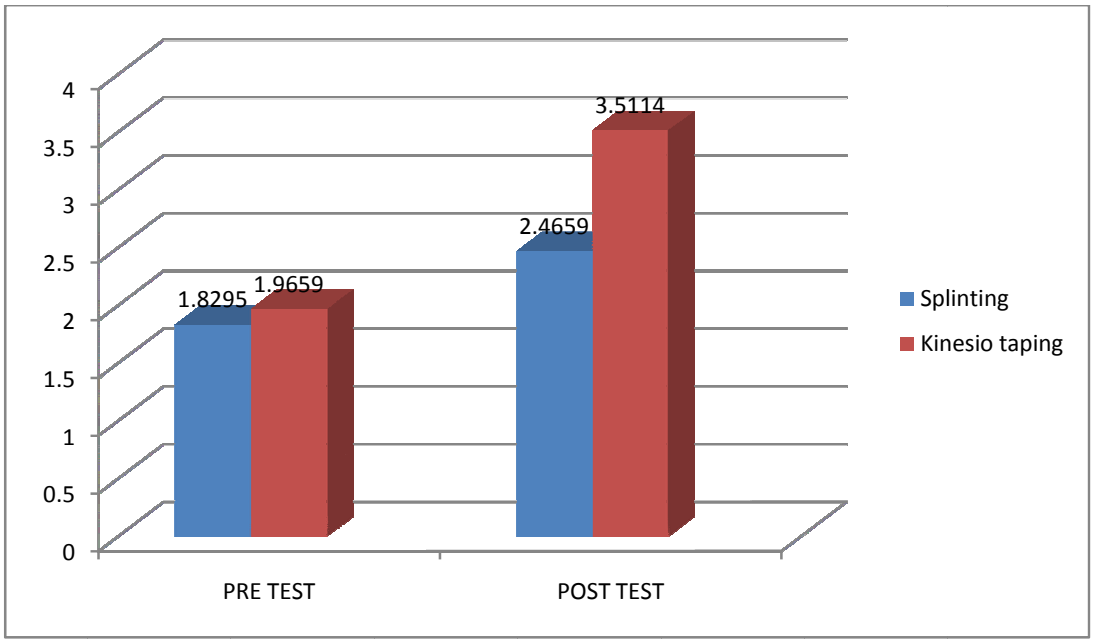
Comparison of Post Test Data of Care Giver Assistance Scale Between Kinesio Taping and Splinting Group (N=11)

VARIABLE	GROUPS	MEAN	S.D	T-VALUE	SIG
Eating	K.T	4.273	0.905	2.331	.003
	SP	3.364	0.924		
Grooming	K.T	3.636	1.206	1.647	.115
	SP	2.909	0.831		
Bathing	K.T	2.727	0.647	2.209	.039
	SP	1.909	1.044		
Dressing Upper Body	K.T	4.182	1.250	4.173	.000
	SP	2.182	0.981		
Dressing Lower Body	K.T	3.637	1.026	3.911	.001
	SP	1.909	1.044		
Toileting	K.T	3.000	1.095	1.62	.121
	SP	2.273	1.009		
Bladder Management	K.T	3.637	1.120	1.092	.288
	SP	3.091	1.221		
Bowel Management	K.T	3.000	0.633	2.887	.009
	SP	2.091	0.831		

The table shows that there is significant difference in Eating, Bathing, Dressing Upper and Lower Body and Bowel management variables. But in Grooming, Toileting and Management of Bladder, there is no significant difference. So the null hypothesis is accepted in these three variables.

GRAPH VIII

Comparison Of Measures Of Caregiver Assisstance (PEDI) Of Splinting And Kinesio Taping



Discussion

DISSCUSSION

The study was conducted in and around Coimbatore, the duration was from December 2010 to January 2011.The samples were selected according to the criteria as mentioned in methodology. 22 children were selected and were divided into experimental and control group.

Diagnosis	Kinesio Tape	Splinting
Quadri	2	3
Di	4	3
Rt. Hemi	3	2
Lt. Hemi	2	3

The primary objective in this study was to find out the hand function and self care performance for spastic CP children with thumb- in- palm deformity. Self care measured by PEDI and hand function measured by EDPA, improved following the application of Kinesio Taping and Splinting. The intervention duration was 12 weeks for both groups. Though the sampling was purposive/judgmental, there was no significant differences among experimental and control group in age, gender and diagnoses.

Variables	Groups	Kinesio Taping		Splinting	
		Number	%	Number	%
Age	< 5 yrs	5	27.23	4	36.37
	> 5 yrs	6	72.73	7	63.67
Gender	Male	5	45.50	7	58.30
	Female	6	54.50	4	36.40

Erhardt Developmental Prehension Assessment

Table II and III compare the base line and outcome measures of Kinesio Taping and splinting respectively. Both tables show highly significant level at 0.01. Table IV compares the base line data for Kinesio Tape and splinting groups. Except release of the pellet, other components show no significant difference in the quantifying measure of EDPA. Table V compares the post test scores of EDPA; it shows that grasp of dowel, cube, pellet and manipulations are highly significant at 0.01 level, where pattern component and release of dowel are not significant in their difference.

Functional skills scale (FSS)

Table VI F_1 and VII F_1 compares the base line data and outcome measures of functional skills- self care domain (feeding and grooming) for Kinesio Taping and splinting. The results of pre-post scores of both groups showed high significant difference.

Table VI F_2 and VII F_2 compare the variables of dressing and toileting. The table VI F_2 for experimental group shows that all the variables are highly significant at 0.00 and 0.01 levels. But the table VII F_2 for control group shows that the differences in dressing is highly significant but in toileting, only the difference in management of bladder is significant at 0.05 level. But the t- values of other components in toileting and management of bowel are 1.936, 1.399 respectively are not significant. It is clearly evident that the differences in the control group are not significant.

The table VI F_2 and VII F_2 comparison shows that the children who participated in experimental group mastered their toilet skill performance better than the control group.

Table VIII compares the base line data measures of FSS for both groups. It shows no significant difference; hence these groups can be computed for statistical analysis.

Table IX F_1 and F_2 compare the post test data measures of functional skills- self care domain for Kinesio Taping and splinting. In the table IX F_1 (feeding and grooming), under feeding the component use of drinking container shows significant difference at the level of 0.05, but for the components of food texture and use of utensils the difference is not significant. Under grooming, all the components show significant level at 0.05 indicating 95% of confidence, except tooth brushing, hair brushing for which the t- values are 1.855, 1.136 not significant. This shows that the differences are not significant. Hence from the above table it is evident that though the experimental group showed improvement same as the control group, the experimental group children mastered some of the areas better than the control group.

Care Giver Assistance (CGA)

Table X and XI compare the base line and outcome measures of CGA Kinesio Taping and splinting group respectively. In table X there exists a highly significant level at 0.00 of all variables in Kinesio Taping group. But table XI shows significant level more or less equal in all the variables as experimental group except eating (t- value- 1.150). It shows the

experimental group care givers felt easier to handle the children while feeding compared to the control group care givers.

Table XII compares the base line data measures of CGA for both groups. It shows no significant difference; hence these groups can be computed for statistical analysis. Table XIII compares the post test scores of experimental and control group on the measure of CGA showing a highly significant level at 0.00 in the components eating, dressing upper and lower body and 0.01 levels in bowel management. But in the other variables the differences are non significant (grooming, toileting and bladder management). The t- values are 1.647, 1.620, 1,092 respectively and the significant levels are 0.115, 0.121, and 0.288.

Outcome Measures of EDPA, FSS And CGA

The overall measures of EDPA Kinesio Tape group shows a significant improvement in grasping and manipulation skills comparatively than the splinting group. The overall measure of CGA and FSS- self care domain tables show that once the children started mastering the performance of self care independently, the care giver assistance started reducing in both groups. But the experimental group children mastered their skills better and the care givers felt more comfortable and easy to handle them than the control group children.

The above discussion conclude that the use of Kinesio Tape as an adjunct to treatment in the paediatric occupational therapy settings to facilitate hand function and self care performance is better than static dorsal cock-up with thumb opponens splint. This result is supported by the studies mentioned in the review of literature.

The researcher observed certain patterns of improvement, which could not be picked up by the scale, as follows based on diagnosis. The experimental group Diplegic type of children showed approximately full independence in hand function which enhanced their performance in self care, comparatively the hemiplegics. In control group hand function improved better than self care. In both groups Quadriplegic showed marginal improvement but experimental group showed better performance comparatively. It showed that though the both groups showed significant improvement, the experimental group showed remarkable change in the level of performance in some of the areas.

Many studies reports that the use of Kinesio Taping as an adjunct to treatment assist with the goal focused occupational therapy treatment during rehabilitation setting to enhance

functional recovery. **Audrey Yasukawa, MOT, OTR (2006)** suggested that limited data exist to support the effectiveness of Kinesio Taping as an adjunct to treatment to facilitate attainment of functional motor skills. The study add on to the evidence that the Kinesio Taping can be used as adjunct during functional training, however randomized control trails are required to confirm the research findings.

During the study period the investigator appreciated the following incidence

- All Children especially CP hemiplegics, who were participated in experimental group started using affected hand spontaneously into function.
- The Mechanical advantage of splinting in control group for MCP instability showed 60-80% of improvement where as in experimental group it was 40-60%.
- Comparatively most of the experimental group children started pre writing skills as reported by occupational therapist, special educator and parents.
- During the study one child underwent intra venous infusion on the dorsum of the hand along with Kinesio Taping application. This shows Kinesio Taping is not affecting the circulation.
- In the experimental group study one of the children was hearing impaired, the child showed similar improvement as the other children.
- In experimental group children showed self correction and counter checked with parents to know whether they have kept the thumb in correct position. Which was not observed in control group.

Maintenance of Functional Skills after Intervention

To determine the lasting effects the 3rd evaluation had been taken after 15 days without application of Kinesio Taping or Splinting. The scores were same as the post test evaluation. Hence statistical analysis was not computed. The functional performance maintained similar in both, but experimental group children showed self correction and kept the thumb in correct position most of the time. Further, this indicates that the children were able to preserve the correction made in thumb -in -palm deformity and thereby improvement of functional skills. However, the experimental group showed self correction which was not noticed in splinting group. This proved that the somato-sensory input through Kinesio Taping has a lasting effect. Further longitudinal with longer duration study is required to determine the permanent effect of Kinesio Taping.

COMPARISON OF KINESIO TAPING AND SPLINTING

Groups	Advantage	Disadvantage	General
Kinesio Taping	❖ Taping provides immediate sensorimotor feedback regarding functional abilities. ❖ It gives free range of motion. ❖ It gives support and stability for the joints and muscles without affecting circulation and range of motion. ❖ Water proof material. ❖ It can be applied for individual or group of muscles. ❖ It can be applied even for a 6 months old baby without any discomfort.	❖ Constant supervision by parent/ care giver is required for some of the children. ❖ Children may become frustrated when learning to handle and manage the tape.	❖ In clients with poor cognitive status also Kinesio Taping and Splinting regimen can be applied by the therapist (but must evaluate the family, care giver or staff member. Education includes medical reasons for the supervision, wearing schedule, home program, precautions and cleaning)

COMPARISON OF KINESIO TAPING AND SPLINTING

Groups	Advantage	Disadvantage	General
Splinting	❖ The clinical reasoning has been depicted in the literature, including interactive, narrative, pragmatic, conditional and procedural reasoning. ❖ It can be applied for severe spastic muscle according to MAS scale grade 3 and above.	❖ Changes of pressure related problem interferes with circulation. ❖ Age is important for many reasons barring other problems, may require careful monitoring by the care giver to ensure a proper fit and compliance with the wearing schedule. ❖ Poor positioning creates chances of Compression Neuropathies of Ulnar nerve at elbow joint and Median nerve at wrist joint. ❖ Wearing schedule was felt difficult by the children. ❖ Long lasting effects in self correction were not satisfactory after the removal of the splint. ❖ Overall cooperation of the children was not much satisfactory.	❖ Both have changes of skin allergy/ irritation. ❖ Timely discontinuation of splinting (hours/ day) and Kinesio Taping is necessary.

Limitation & Recommendations

LIMITATION AND RECOMMENTATIONS

The study had certain limitations that could affect generalization of the results,

- ❖ The subjects were not assigned randomly and samples size was small which would propose for further study with grouping of samples randomly as well as in a large sample size.

- ❖ In both groups playfulness of the children sibling and peer group was a factor which led to mishandling the tape.

- ❖ The study recommends some of the areas which would propose for further study.

    - Still more effective on comparing with dynamic splint
    - Application of Kinesio Tape for postural stability along with wrist and hand function for Indian population
    - The study can be done on evaluating a child in a school performance

Conclusion

CONCULUSION

- The study was proposed to compare the effectiveness of Kinesio Taping and splinting to enhance hand function and self care in children with cerebral palsy.

- The results of this study favoured the first and second alternate hypotheses by showing a significant improvement in hand function and self care.

- The third alternate hypothesis is also proved in most of the areas in experimental group showing a significant improvement especially in grasping, manipulation, feeding and dressing comparatively than the splinting group.

- In FSS and CGA results show that, once the children started mastering the performance of self care independently the caregiver assistance started reducing in both groups. But the experimental group children mastered their skills better and the caregiver felt easiness while handling them than the control group children.

- The lasting effect of functional performance of the children in the Kinesio Taping group, while comparing the splinting group, is more satisfactory.

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WEBSITES

- www.mckiesplints.com
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- www.kinesiotaping.com

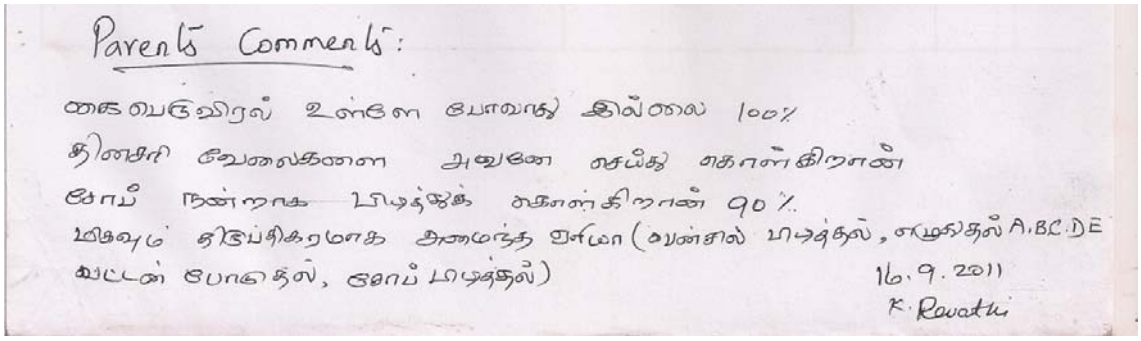
Appendix

ACTIVITIES

- Home Self-care Activities and Table Top Activities for 20 minute minimum a day
    1. “O” Game/Open web space game.
    2. Hand separation game.
    3. Finger tug of war.
    4. Connect four.
    5. Thumb and Finger painting.
    6. Spinning a top.

Parents Report after kinesio Taping intervention

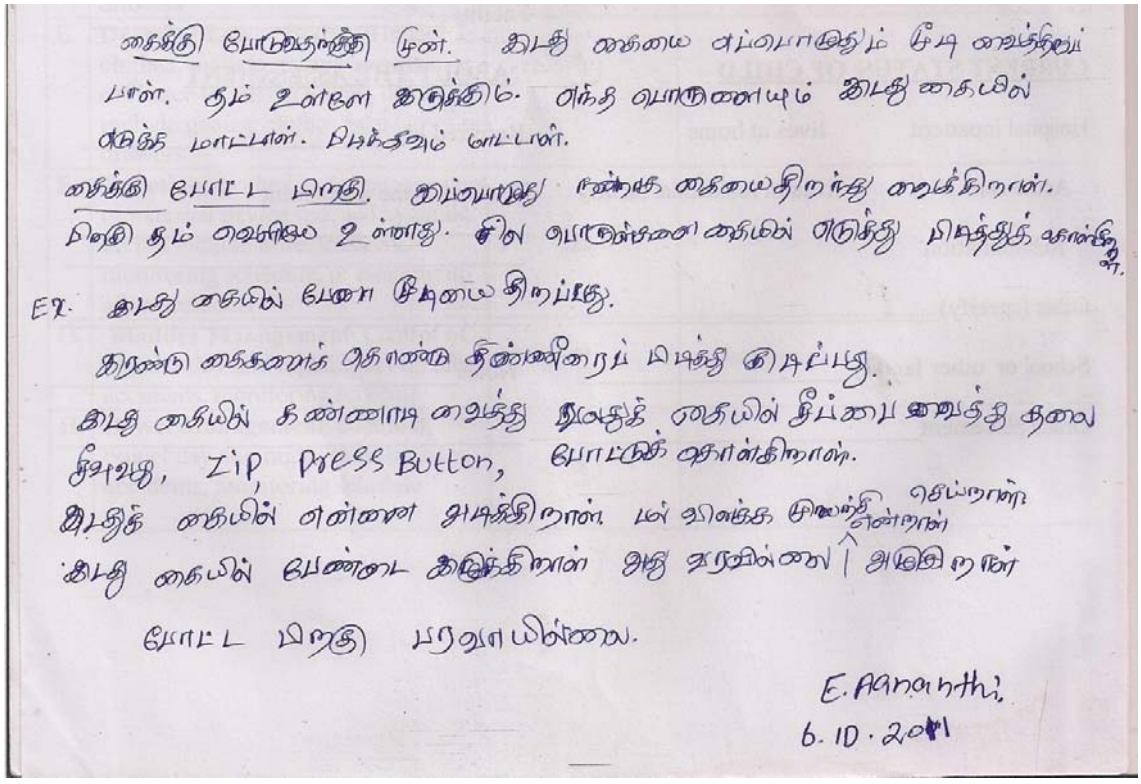
Diplegic 5 years boy child



Parents Comments:

கைவெருவிரல் உள்ளே போவது இல்லை 100%
தினசரி வேலைகளை அவனே செய்து கொள்கிறான்
சோப் நன்றாக பிடித்துக் கொள்கிறான் 90%.
மிகவும் திருப்திகரமாக அமைந்த முறை (சுவரில் பிடித்தல், எழுதுதல் A,B,C,D,E
கூட்டல் போடுதல், சோப் பிடித்தல்) 16.9.2011
K. Revathy

Left hemiplegic 4 year child with hearing impairment



தைத்தி போடுவதற்கு முன். இடது கையை எப்பொழுதும் மூடி வைத்திருப்பாள். தும் உள்ளே இருக்கும். எந்த பொருளையும் இடது கையில் வைக்க மாட்டாள். பிடிக்கவும் மாட்டாள்.

தைத்தி போட்ட பிறகு. எப்பொழுது வலது கையைதிறந்து வைக்கிறாள். நெறி தும் வெளியே உள்ளது. சில பொருள்களை கையில் பிடித்து விளையாடுகிறாள்.

Ex. இடது கையில் பேனா பிடிப்பதை திறப்பது.

திறந்து கைகளைக் கண்ணை மூடிக் கொண்டு தண்ணீரைப் பிடித்து விடுவது.

இடது கையில் கண்ணாடி வைத்து நீயதைக் கையில் தீப்பை வைத்து தலை சீவுவது, Zip press Button, போட்டுக் கொள்கிறாள்.

இடதுக் கையில் என்னை அடிக்கிறாள் மன் விளங்க மாட்டேன் என்றால் செய்கிறாள்

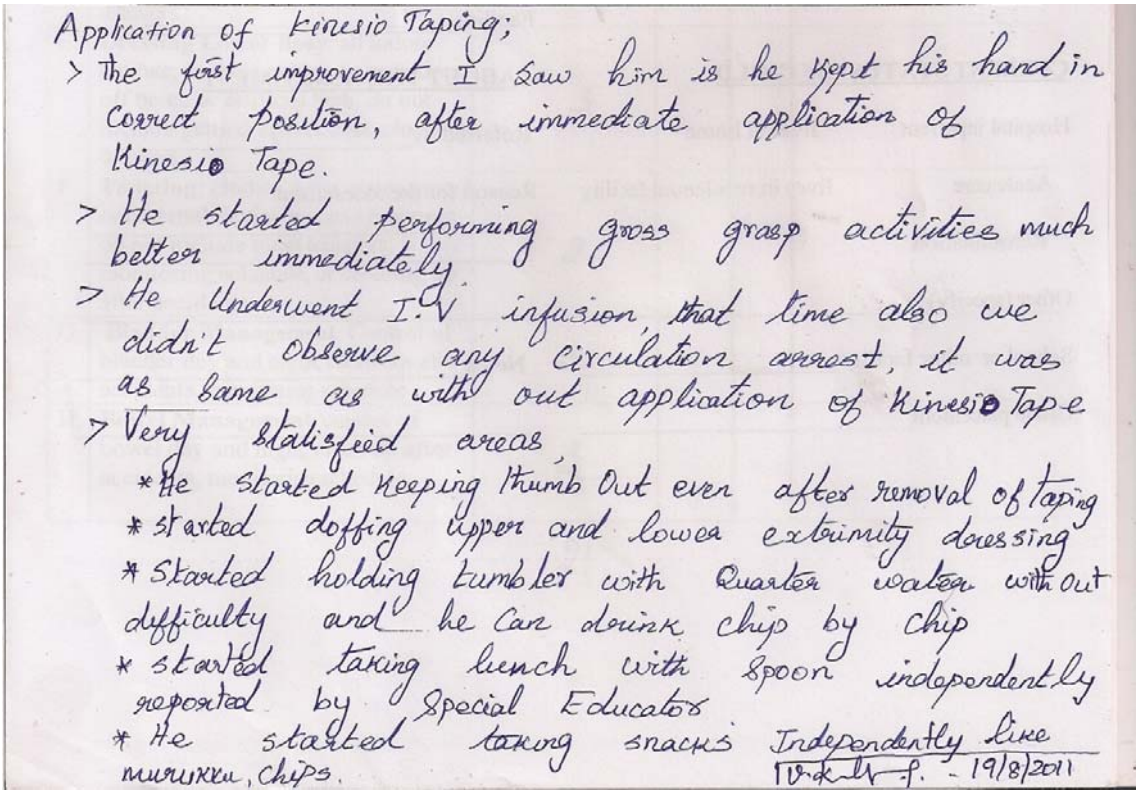
இடது கையில் வேண்டை கடிக்கிறாள் அது தரவில்லை / அழுகிறாள்

போட்ட பிறகு பரவாயில்லை.

E. Ramanathi
6.10.2011

Parents Report after kinesio Taping intervention

Quadriplegic; 8 year 6mo old boy.



Application of kinesio Taping;

> The first improvement I saw him is he kept his hand in correct position, after immediate application of kinesio Tape.

> He started performing gross grasp activities much better immediately

> He Underwent I.V infusion, that time also we didn't observe any circulation arrest, it was as same as with out application of kinesio Tape

> Very satisfied areas

* He started keeping thumb Out even after removal of taping
* started doffing upper and lower extrimity dressing
* Started holding tumbler with Quarter water with out difficulty and he can drink chip by chip
* started taking lunch with spoon independently reported by Special Educator
* He started taking snacks Independently like murukku, chips.

19/8/2011

MASTER CHART
ERHARDT DEVELOPMENTAL PREHENSION ASSESSMENT - PRE TEST
KINESIO TAPPING

Subject	Age in Months	Sex	Diagnosis	The arm on approach		Grasp of the dowel		Grasp of the cube		Grasp of the Pellet		Pattern component		Manipulation Skill		Release of the dowel		Release of the pellet	
				L	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**
1	96	B	Q	8	8	7	7	5	5	7	7	8	8	8	8	6	6	8	8
2	54	G	Q	6	6	4	4	4	4	6	6	7	7	8	8	6	6	8	8
3	78	G	D	12	12	10	10	9	9	10	10	15	15	15	15	10	10	14	14
4	96	B	R	8	12	4	10	5	9	6	12	15	15	15	15	10	12	12	15
5	66	G	D	10	10	7	7	6	6	7	9	12	12	12	12	8	8	9	9
6	54	B	D	12	12	9	9	9	9	10	10	15	15	15	15	12	12	14	14
7	54	G	R	8	12	5	10	5	9	9	12	15	15	15	15	10	12	12	15
8	90	B	D	12	12	10	10	9	9	9	9	15	15	15	15	10	10	12	12
9	60	B	R	8	12	7	10	7	9	7	12	15	15	15	15	8	12	10	15
10	66	G	L	12	10	10	5	9	5	10	7	15	9	12	8	12	9	15	9
11	42	G	L	12	8	10	8	9	5	12	7	15	12	12	12	12	7	14	8
TOTAL				**108**	**114**	**83**	**90**	**77**	**79**	**93**	**101**	**147**	**138**	**142**	**138**	**104**	**104**	**128**	**127**

ERHARDT DEVELOPMENTAL PREHENSION ASSESSMENT- POST TEST

KINESIO TAPING

Subject	Age in Months	Sex	Diagnosis	The arm on approach		Grasp of the dowel		Grasp of the cube		Grasp of the Pellet		Pattern component		Manipulation skill		Release of the dowel		Release of the pellet	
				L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
				12	12	10	10	9	9	12	12	15	15	15	15	12	12	15	15
1	96	B	Q	12	12	10	10	8	8	9	9	10	10	12	12	10	10	14	14
2	54	G	Q	12	12	10	10	9	9	10	10	10	10	12	12	9	9	10	10
3	78	G	D	12	12	10	10	9	9	12	12	15	15	15	15	12	12	15	15
4	96	B	R	12	12	8	10	7	9	7	12	15	15	15	15	12	12	12	15
5	66	G	D	12	12	9	9	8	8	9	10	15	15	15	15	12	12	14	14
6	54	B	D	12	12	10	10	9	9	12	12	15	15	15	15	12	12	15	15
7	54	G	R	12	12	10	10	8	9	10	12	15	15	15	15	12	12	15	15
8	90	B	D	12	12	10	10	9	9	12	12	15	15	15	15	12	12	15	15
9	60	B	R	12	12	9	10	9	9	10	12	15	15	15	15	12	12	14	15
10	66	G	L	12	12	10	10	9	8	12	10	15	15	15	15	12	12	15	12
11	42	G	L	12	12	10	10	9	9	12	10	15	15	15	15	12	12	15	14

ERHARDT DEVELOPMENTAL PREHENSION ASSESSMENT - PRE TEST

SPLINTING

Subject	Age in Months	Sex	Diagnosis	The arm on approach		Grasp of the dowel		Grasp of the cube		Grasp of the Pellet		Pattern component		Manipulation Skill		Release of the dowel		Release of the pellet	
				L	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**	**R**
1	66	B	L	12	10	10	5	9	5	12	7	15	15	15	15	12	9	15	9
2	84	G	L	12	8	10	5	9	5	12	7	15	15	15	15	12	9	15	9
3	84	B(L)	Q	12	8	10	7	8	6	9	6	15	15	15	15	12	8	14	8
4	72	B	Q	8	8	7	7	5	5	7	7	8	8	8	8	6	6	8	8
5	90	B	R	12	12	7	10	6	9	7	12	12	15	10	15	8	12	10	15
6	54	B	R	10	12	5	10	5	9	7	12	12	15	10	15	8	12	9	15
7	66	B	D	10	10	7	7	6	6	8	8	15	15	10	10	8	8	8	8
8	42	G	L	12	10	10	5	9	5	12	7	15	15	15	15	12	9	15	9
9	72	G	D	12	12	10	7	8	6	10	8	12	12	10	10	8	8	9	9
10	60	G	Q	10	10	5	5	4	4	6	6	8	8	8	8	7	7	7	7
11	66	B	D	10	10	7	7	5	5	7	7	8	8	8	8	6	6	9	9
TOTAL				**120**	**110**	**88**	**75**	**74**	**65**	**97**	**87**	**135**	**141**	**124**	**134**	**99**	**94**	**119**	**106**

ERHARDT DEVELOPMENTAL PREHENSION ASSESSMENT- POST TEST

SPLINTING

Subject	Age in Months	Sex	Diagnosis	The arm on approach		Grasp of the dowel		Grasp of the cube		Grasp of the Pellet		Pattern component		Manipulation skill		Release of the dowel		Release of the pellet	
				L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
1	66	B	L	12	12	10	9	9	8	12	8	15	15	15	15	12	12	15	14
2	84	G	L	12	12	10	9	9	9	12	10	15	15	15	15	12	12	15	15
3	84	B	Q	12	12	9	9	8	8	9	7	15	15	15	15	12	12	14	14
4	72	B	Q	12	12	8	8	7	7	8	8	10	10	10	10	8	8	9	9
5	90	B	R	12	12	10	10	8	9	9	12	12	15	12	15	10	12	12	15
6	54	B	R	12	12	8	10	7	9	8	12	12	15	12	15	10	12	12	15
7	66	B	D	12	12	9	9	8	8	9	9	15	15	12	12	12	12	12	12
8	42	G	L	12	12	10	10	9	9	12	9	15	15	15	15	12	12	15	12
9	72	G	D	12	12	10	9	9	9	10	9	15	15	15	15	12	12	14	14
10	60	G	Q	12	12	8	8	6	6	7	7	12	12	10	10	9	9	9	9
11	66	B	D	12	12	9	9	8	8	9	9	12	12	10	10	9	9	12	12
TOTAL				**132**	**132**	**101**	**100**	**88**	**90**	**105**	**100**	**148**	**154**	**141**	**147**	**118**	**122**	**139**	**141**

BASE LINE MEASURE OF FUNCTIONAL SKILLS / SELF CARE DOMAIN

KINESIO TAPING

S.No	Age in months	sex	Diag nosis		A.	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Total score
				Normal score	**4**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**73**
1	96	B	Q		4	0	0	1	1	0	0	0	1	0	1	0	1	3	4	16
2	54	G	Q		4	1	0	1	0	0	0	0	0	0	1	0	0	1	1	9
3	78	G	DI		4	4	3	3	2	5	4	1	2	3	1	2	1	5	5	45
4	96	B	RT.H		4	0	2	3	2	3	3	1	1	1	3	0	2	5	5	35
5	66	G	DI		4	0	2	3	2	1	3	1	1	2	3	2	1	5	5	35
6	54	B	DI		4	3	2	2	2	3	3	1	2	2	3	0	2	5	5	39
7	54	G	RT.H		4	4	2	4	2	5	3	3	3	2	2	3	2	5	5	49
8	90	B	DI		4	4	2	4	3	3	3	2	2	2	3	3	2	5	5	47
9	60	B	R.H		4	2	2	3	2	3	3	1	3	2	3	2	1	4	4	39
10	66	G	L.H		4	3	3	3	2	3	2	1	2	2	3	2	1	4	4	39
11	42	G	L.H		4	0	0	1	1	2	1	0	1	0	1	0	0	0	0	11

ITMES	SCORE
A. Food textures (1- 4) B. Use of Utensils (5-9) C. Use of drinking containers (10-14) D. Tooth brushing (15-19) E. Hair brushing (20-23) F. Nose care (24-28) G. Hand washing (29-33) H. Washing body and face (34-38) I. Pull over / front opening garments (39-43) J. Fastness (44-48) K. Pants (49-53) L. Foot wear (54-58) M. Toilet tasks (cloths and toilet management and wiping only (59-63) N. Management of bladder (64-68) O. Management of bowel (69-73)	0 = Unable or limited in capability to perform item in most situation 1 = capable of performing item in most situations, or item has been previously mastered and functional skills have progressed beyond this level

FUNCTIONAL SKILLS / SELF CARE DOMAIN –KINESIO TAPING POST-TEST SCORES

S.No	Age in months	Sex	Diag nosis		A.	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Total Score I	III
				n	**4**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**73**	**73**
1	96	B	Q		4	3	2	3	2	3	2	2	3	1	3	0	1	4	4	37	37
2	54	G	Q		4	2	4	3	2	3	2	2	3	0	4	0	1	3	2	35	35
3	78	G	Di		4	4	5	5	4	5	5	4	5	5	5	5	3	5	5	69	69
4	96	B	Rt. Hemi		4	0	4	5	3	5	5	3	5	5	5	5	3	5	5	62	62
5	66	G	Di		4	4	5	4	3	4	5	4	5	5	4	5	3	5	5	65	65
6	54	B	Di		4	3	5	5	3	5	5	5	5	5	5	4	4	5	5	68	68
7	54	G	Rt. Hemi		4	5	5	5	4	5	5	5	5	5	5	5	4	5	5	72	72
8	90	B	Di		4	5	5	5	4	5	5	4	5	5	4	5	3	5	5	69	69
9	60	B	Rt. Hemi		4	5	5	5	4	5	5	3	5	5	5	5	3	5	5	69	69
10	66	G	Lt. Hemi		4	3	5	4	3	5	5	3	5	4	4	4	3	5	5	61	61
11	42	G	Lt. Hemi		4	4	5	3	3	5	4	2	1	3	2	2	1	1	1	41	41
				Total	44	38	50	47	35	50	48	37	47	43	46	40	29	48	47	648	648

BASELINE MEASURES OF FUNCTIONAL SKILLS / SELF CARE DOMAIN - SPLINTING

S.No.	Age in months	Sex	Diag nosis		A.	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Total score
				n	**4**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**73**
1	66	B	L.H		4	4	4	2	2	5	3	1	1	1	2	2	1	4	5	41
2	84	G	L.H		4	4	3	4	2	3	2	0	1	0	2	3	1	5	5	39
3	84	B	Q		4	1	2	3	2	5	2	1	2	1	1	3	1	4	4	36
4	72	B	Q		4	1	1	2	2	2	0	0	1	0	1	0	1	4	4	23
5	90	B	R.H		4	4	4	4	4	5	3	2	2	0	4	4	3	4	4	51
6	54	B	R.H		4	1	3	2	3	3	3	1	1	1	3	3	1	4	4	37
7	66	B	DI		4	2	3	3	2	3	1	1	1	0	1	2	1	4	4	32
8	42	G	L.H		4	3	3	1	1	1	0	0	0	0	0	1	1	3	4	22
9	72	G	DI		4	4	2	3	3	3	3	2	2	1	2	2	1	4	4	40
10	60	G	Q		4	0	1	1	1	2	0	0	1	0	0	0	1	3	4	18
11	66	B	DI		3	1	1	1	1	1	0	1	0	0	0	1	1	1	0	12

n= normal score

FUNCTIONAL SKILLS / SELF CARE DOMAIN –SPLINTING POST-TEST SCORES

S.No.	Age in months	Sex	Diag nosis		A.	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Total Score I	III
				n	**4**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**73**	**73**
1	96	B	Q		4	4	4	4	4	5	4	3	3	2	4	4	1	5	5	56	56
2	54	G	Q		4	4	4	5	3	3	3	2	2	2	4	4	2	5	5	52	52
3	78	G	Di		4	3	4	3	3	5	5	2	2	2	3	3	1	4	4	48	48
4	96	B	Rt. Hemi		4	3	3	2	2	3	2	0	1	2	2	1	1	4	4	34	34
5	66	G	Di		4	5	5	4	3	5	5	3	2	2	3	4	3	4	4	56	56
6	54	B	Di		4	4	4	4	4	4	4	3	2	3	3	4	2	5	5	55	55
7	54	G	Rt. Hemi		4	4	4	3	3	3	3	3	2	2	2	3	1	4	4	45	45
8	90	B	Di		5	3	4	3	2	2	1	2	1	1	2	2	1	4	4	37	37
9	60	B	Rt. Hemi		4	5	3	5	3	4	4	4	2	2	2	3	2	4	4	51	51
10	66	G	Lt. Hemi		4	1	2	3	2	3	3	2	2	2	2	1	1	3	4	35	35
11	42	G	Lt. Hemi		3	3	2	3	2	2	1	2	1	2	0		21	2	2	28	28
				Total	44	39	39	39	31	39	35	26	20	22	27	31	16	44	45	497	497

CARE GIVER ASSISTANCES / SELF CARE DOMAIN - PRE TEST KINESIO – TAPPING

Subject	Age in months	Sex	Diagnosis	A	B	C	D	E	F	G	H	Total Score
1	96	B	Q	1	0	1	1	1	1	2	2	**9**
2	54	G	Q	2	1	0	0	0	0	1	1	**5**
3	78	G	D	5	2	2	3	1	2	2	2	**19**
Ca	96	B	L	3	3	3	3	3	3	4	3	**25**
5	66	G	D	3	3	2	2	2	1	1	1	**15**
6	54	B	D	3	3	2	3	2	2	3	2	**20**
7	54	G	R	3	2	1	2	2	2	3	2	**17**
8	90	B	D	3	3	2	3	2	5	3	3	**24**
9	60	B	R	2	2	1	2	2	2	3	3	**17**
10	66	G	L	3	2	1	2	2	2	3	2	**17**
11	42	G	L	2	1	1	1	0	0	0	0	**5**
				30	**22**	**16**	**22**	**17**	**20**	**25**	**21**	**173**

ITEMS

A. Eating
B. Grooming
C. Bathing
D. Dressing Upper Body
E. Dressing Lower Body
F. Toileting
G. Bladder Management
H. Bowel Management

SCORES

5 = Independent
4 = Supervise/Prompt/Monitor
3 = Minimal Assistance
2 = Moderate Assistance
1 = Maximal Assistance
0 = Total Assistance

CARE GIVER ASSISSTANCE/ SELF CARE DOMAIN-POST TEST

KINESIO TAPING

Subject	Age in months	Sex	Diagnosis	A	B	C	D	E	F	G	H	Total Score
1	96	B	Q	3	3	2	3	3	2	3	3	**22**
2	54	G	Q	3	2	2	2	2	1	2	2	**16**
3	78	G	D	5	3	3	5	4	3	3	3	**29**
4	96	B	L	5	4	4	5	5	4	5	4	**36**
5	66	G	D	5	5	3	5	4	3	3	3	**31**
6	54	B	D	5	5	3	5	5	3	5	3	**34**
7	54	G	R	4	3	3	5	4	4	4	3	**30**
8	90	B	D	5	5	3	5	4	5	4	4	**35**
9	60	B	R	5	5	3	5	4	3	5	3	**33**
10	66	G	L	4	3	2	4	3	3	4	3	**26**
11	42	G	L	3	2	2	2	2	2	2	2	**17**
				47	**40**	**30**	**46**	**40**	**33**	**40**	**33**	**309**

CARE GIVER ASSISTANCES / SELF CARE DOMAIN - PRE TEST

SPLINTING

Subject	Age in months	Sex	Diagnosis	A	B	C	D	E	F	G	H	Total Score
1	66	B	L	4	2	2	2	2	2	4	2	**20**
2	84	G	L	4	2	1	3	3	2	5	3	**23**
3	84	B	Q	4	3	0	1	0	1	1	1	**11**
4	72	B	Q	2	1	1	1	1	0	2	2	**10**
5	90	B	R	5	4	3	1	2	2	2	1	**20**
6	54	B	R	3	3	2	3	2	4	3	2	**22**
7	66	B	D	2	2	1	2	1	2	2	1	**13**
8	42	G	L	3	3	0	1	1	1	2	1	**12**
9	72	G	D	4	2	2	2	1	2	4	1	**18**
10	60	G	Q	1	1	0	0	0	1	1	1	**5**
11	66	B	D	2	1	0	1	1	0	1	1	**7**
				34	**24**	**12**	**17**	**14**	**17**	**27**	**16**	**161**

CARE GIVER ASSISTANCES / SELF CARE DOMAIN - POST TEST

SPLINTING

Subject	Age in months	Sex	Diagnosis	A	B	C	D	E	F	G	H	Total Score
1	66	B	L	4	3	3	3	3	2	5	2	**25**
2	84	G	L	4	3	2	4	4	3	5	4	**29**
3	84	B	Q	4	4	1	2	2	2	2	2	**19**
4	72	B	Q	2	2	2	3	2	1	2	2	**16**
5	90	B	R	4	4	3	2	2	3	3	2	**23**
6	54	B	R	4	4	3	3	3	4	4	3	**28**
7	66	B	D	4	3	2	2	1	3	3	1	**19**
8	42	G	L	3	2	1	1	1	1	2	2	**13**
9	72	G	D	4	3	3	2	1	3	4	2	**22**
10	60	G	Q	2	2	1	1	1	1	2	1	**11**
11	66	B	D	2	2	0	1	1	2	2	2	**12**
				37	**32**	**21**	**24**	**21**	**25**	**34**	**23**	**217**